MIT Beaver Works Summer Institute

MIT Beaver Works Summer Institute 2022

VIRTUAL HIGH SCHOOL PROGRAM

Raytheon Intelligence & Space Project

Autonomous RACECAR Grand Prix

BAE Systems Project

Autonomous Air Vehicle Racing

Autonomous Cognitive Assistant

Remote Sensing

Sierra Nevada Corp. Project

Build a CubeSat

UAS-SAR

Serious Game Design and Development with AI

MITRE Project

Embedded Security and Hardware Hacking

Data Science for Health & Medicine

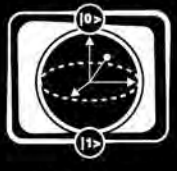
Assistive Technology

Cyber Operations

ONR Autonomous Maritime Engineering Project

Autonomous Underwater Vehicle Challenge

MITRE Project



Quantum Software

AeroAstro MIT | BEAVER WORKS Lincoln Laboratory | School of Engineering | CSAIL | MIT EECS

LINCOLN LABORATORY MASSACHUSETTS INSTITUTE OF TECHNOLOGY | MITMECHE | Open Learning | School of Engineering

Massachusetts Institute of Technology

MIT Lincoln Laboratory

MIT Lincoln Laboratory / School of Engineering Beaver Works

MIT Beaver Works Summer Institute

Dear Friends, Family, and Engineering Enthusiasts,

The brochure below includes all the information on the 2022 Beaver Works Summer Institute, hybrid virtual and in-person program! Due to the COVID-19 situation we will not be able to host the same amount of onsite courses this summer, but we are excited to offer several of our most popular classes in an online only format and some in-person. As we work with MIT we will announce which programs will be in-person and which will be virtual for 2022. We are looking forward this summer to pushing the boundaries of BWSI with our instructors and students. This format will be an important step in making the incredible BWSI content available to broader audiences.

The MIT Beaver Works Summer Institute is a rigorous, world-class STEM program for talented rising high school seniors. BWSI started in 2016 with a single class and has grown exponentially since. The 2021 program featured thirteen project-based, workshop-style courses: Autonomous RACECAR Grand Prix, Autonomous Air Vehicle Racing, Autonomous CognitiveAssistant, Data Science for Health and Medicine, Build a CubeSat, UAS-Synthetic Aperture Radar (UAS-SAR), Embedded Security and Hardware Hacking, Designing for Assistive Technology, Remote Sensing for Disaster Response, and Hack a 3D Printer.

The 2021 MIT Beaver Works Summer Institute was the biggest class ever thanks to the enthusiasm of our students, the dedication of our instructors, and the hard work of our team members. We leaned forward into creating more virtual programs that included more kits to send to students to use as part of their course projects. Courses like Build a CubeSat, Designing Assistive Technology, and Autonomous Underwater Vehicle Challenge used kits to help students build and by building learn. It's been incredible to see the engagement and interest in these college-level courses from all the students, the teamwork and community this year was something the students will never forget.

In the coming years, we will integrate new programs into this initiative, and make the summer program content available broadly. We are supporting middle and high school STEM teachers who use our teaching materials to help better prepare their students for college and beyond. We will also help other universities and high schools create similar programs, working to build a network of institutes to collectively improve engineering education worldwide. While the movement to an online only BWSI this summer was a difficult decision, it will accelerate the development of a more modular and portable course content that can be shared widely and have a greater impact on our leaders of tomorrow.

Thank you for the continued support of our program.

The MIT Beaver Works Summer Institute Staff

What is Beaver Works Summer Institute?

The MIT Beaver Works Summer Institute (BWSI) is a rigorous, world-class STEM program for talented students who will be entering their senior year in high school. The four-week program teaches STEM skills through project-based, workshop-style courses. BWSI began in 2016 with a single course offered to 46 students, a mix of local daytime students and out-of-state residential students. In this course, RACECAR (Rapid Autonomous Complex Environment Competing Ackermann steering), students programmed small robotic cars to autonomously navigate a racetrack.

The positive student reaction to our hands-on learning style led to the expansion of the program to include two new courses in 2017. To make sure students had the STEM background to participate fully in the three courses, the BWSI instructors developed online tutorials that students had to complete as a prerequisite for applying for the summer program. The new courses were Autonomous Air Vehicle Racing and Autonomous Cognitive Assistant. In 2017, 98 students from 49 high schools nationwide enjoyed BWSI.

In 2018, we grew again. This year, we had eight courses, adding five ones; each new course is developed with a requisite online tutorial. The 2018 class of BWSI boasted 198 young people from 106 high schools from across the country and Puerto Rico.

In 2019, we grew yet again and added two new courses to our eight. The 2019 class of BWSI grew to 239 students from 158 high schools across the country and Puerto Rico. As in the previous two years, we have had teams from Massachusetts and outside the United States participate in our RACECAR Grand Prix after they completed the course curriculum on their own.

In 2020, we offered 7 courses and 1 independent project virtually thanks to substantial efforts to shift the onsite program. BWSI partnered with many high schools to recruit future engineers to participate in our program, and had the pleasure of working with 178 students from 101 high schools across the country for the seven courses offered this year.

We stayed virtual in 2021 for our main program, and even expanded to 13 courses adding more autonomous systems, cyber-security, software and engineering courses. We have over 351 students participating in our program from over 200 high schools. It is one of most diverse group of students yet, with 43% young women. We also were able to support 2 in-person programs in Huntsville AL, and on Kwajalein.

Expansion in the coming years will focus on developing new courses and working with collaborators to scale up the program nationally and internationally. We will continue to advise high school STEM teachers who want to incorporate the BWSI concepts and materials into their classrooms. Our vision is a broad network of BWSI-like programs that will help improve engineering education, and toward that goal, we will share our work and ideas with universities and schools worldwide.

Contact us at bwsi-admin@mit.edu for information on how to adopt this program into your school curriculum.

What is Beaver Works?

Beaver Works is a joint venture between MIT Lincoln Laboratory and the MIT School of Engineering that is envisioned as an incubator for research and innovation. Beaver Works facilitates project-based learning, a hallmark of an MIT education, and leverages the expertise and enthusiasm of MIT faculty, students, researchers, and Lincoln Laboratory staff to broaden partnerships across both institutions.

The Beaver Works center located in Cambridge, Massachusetts, provides these facilities: areas for collaborative brainstorming; workshops and tools for fabricating prototype systems; and space for classroom-style instruction. Beaver Works allows students to address real-world problems and issues, engages students in hands-on learning, and demonstrates an effective strategy for teaching complex engineering concepts.

Beaver Works supports MIT student involvement in a range of research and educational pursuits, including two-semester, course-based capstone projects; joint and individual research initiatives; and Undergraduate Research Opportunities Program internships. Students involved in these projects develop innovative solutions to real-world problems and gain an exceptional experience in hands-on learning from world-class researchers.

In addition to the Summer Institute, Beaver Works is also extending project-based learning opportunities to local K–12 school children. Among these offerings have been a robotics workshop for an all-girl FIRST (For Inspiration and Recognition of Science and Technology) LEGO League team, a hands-on camera-building activity for high-school girls, and LLRISE, a one-day workshop on radars for students in middle school.

MIT Beaver Works Summer Institute

2022 Summer Program: Course Overview

BWSI expects some mixture of the below courses to be held in either a virtual or in-person format for 2022. We will make an announcement in early 2022.

The MIT Beaver Works Summer Institute expects most of the below courses to be held in either a virtual or in-person format for 2022. We will make an official course announcement in early 2022. For more information on each course, see the following pages in this brochure.

Autonomous RACECAR Grand Prix

Beaver Works Summer Institute will offer students, each with its own MIT-designed RACECAR robot, the opportunity to explore the broad spectrum of research in autonomy; learn to collaborate, and demonstrate fast, autonomous navigation in a Mini Grand Prix to ***Move... Explore... Learn...Race!***

Autonomous Cognitive Assistant

Beaver Works Summer Institute will offer students an opportunity to learn about the cutting-edge in machine learning. Cog*Works consists of project-based modules for developing machine learning apps that leverage audio, visual, and linguistic data. Students will work with experts in these fields to learn foundational mathematical, programming, and data analysis skills, which will enable them to create their own algorithms and neural networks from scratch. Ultimately, they will design their own cognitive assistants.

Build a CubeSat

Beaver Works Summer Institute will offer students the opportunity to design, build,and test a prototype CubeSat. Students will explore all the major subsystems of a satellite and get hands on experience with mechanical, electrical, and software engineering. The class will use these new skills to demonstrate a real CubeSat science mission in partnership with scientists from Woods Hole Oceanographic Institution.

Assistive Technology

BWSI Assistive Technology will help students develop skill for product design, rapid prototyping, and product testing as they create technology solutions for people living with disabilities. We will tackle real problems faced by collaborating with people who have disabilities in your local community, and learn to work with the end users, stepping through the engineering design process together to come up with personalized, creative solutions.

Cyber Operations

Beaver Works Summer Institute will help students learn and understand cyber security The program will introduce students to techniques for conducting full-spectrum cyber operations from: networking, system administration, cyber threat intelligence, network defense, digital forensics, malware analysis, and additional cybersecurity techniques. The course will culminate a digital field training exercise (FTX) event consisting of several mystery tasks derived from several phases of the course.

Embedded Security and Hardware Hacking – MITRE Project

Beaver Works Summer Institute will cover several cybersecurity topics with a focus on threats that are especially concerning for embedded systems. These topics include cryptography, embedded systems, software security, side-channel analysis, and fault-injection. This background will help prepare students for the summer course, during which they will design and perform security assessments of multiple implementations of an embedded system. They will learn the basics of embedded security and hardware hacking by designing a secure system and performing security assessments of classmates' designs to see who can find and fix the most security flaws.

Medlytics (Data Science for Health & Medicine)

Beaver Works Summer Institute will give students a chance to explore the exciting intersection of data science and medicine. Students will build a solid foundation in the fundamentals of probability and statistics, and learn the basics of coding and machine learning techniques through a series of online teaching modules. During the summer, students will work in groups to gain hands-on experience applying advanced machine learning and data mining to solve real-world medical challenges.

Quantum Software - MITRE Project

Beaver Works Summer Institute will offer students a chance to learn about quantum computing and algorithms. Students will learn fundamentals of quantum mechanics that make qubits unique and important to solving hard computational problems and develop algorithms that make use of qubit properties like superposition and entanglement. Students will be able to use quantum computing simulators to test their ideas andalgorithms and explore the incredible opportunities with this technology.

Remote Sensing For Disaster Response

Beaver Works Summer Institute Remote Sensing program will offer students the opportunity to explore the exciting intersection of data science and disaster response. The program consists of two components: (1) online course from February to May 2022, open to all interested and committed students; and (2) a four-week virtual summer program. During the course, the students will learn to understand the basics of Python, Git, GIS, machine learning, and image processing through a series of online teaching modules. Students will explore real world datasets featuring disaster imagery from both satellites and aerial platforms. Students in this course will develop experience in an area of data science that is poised to play a critical role in understanding our world.

Serious Game Development with AI

Combine modern methods in machine learning and game-like modeling to quantitatively analyze socially relevant technology and policy questions. This year's application will be tactical routing for self-driving ambulances. We will build an analysis framework in Python to study the technical, moral, and strategic opportunities that new technologies present to that application. There will also be an emphasis on learning the practical tools and kills for working on a professional software development team

Autonomous Underwater Vehicles Challenge

Learn basic hydrodynamics, vehicle control and image recognition. Build a custom underwater vehicle and program it to navigate an obstacle course autonomously.

Autonomous Air Vehicle Racing

Beaver Works Summer Institute will offer students the opportunity to explore some new areas of research and to design their own autonomous capabilities for UAVs (unmanned aerial vehicles). The students will work in teams to develop algorithms for deployment to an advanced quadrotor, the DJI/Ryze Tello Drone. They will use the Robot Operating System (ROS), popular open-source libraries, and custom algorithms to program the quadrotors to compete in an autonomous navigation event.

Unmanned Air System – Synthetic Aperture Radar

Beaver Works Summer Institute will introduce students to Synthetic Aperture Radar (SAR) imaging as they build and fly a radar on a small Unmanned Aerial System (UAS) and use it to image scenes around campus. Students will work in small teams alongside their instructors to gain hands-on experience building, integrating, and processing data from a radar to generate SAR images. Teams will compete to create the UAS-SAR capable of producing the clearest images possible.

MIT Beaver Works Summer Institute

2022 Summer Program

Autonomous RACECAR Remote Challenge

Program Overview

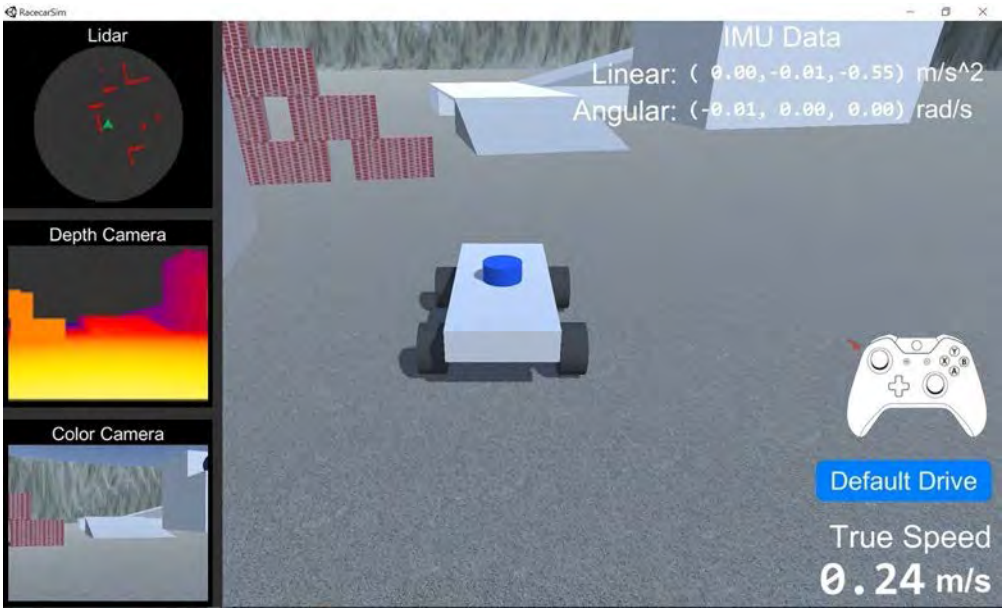
Driverless vehicle technology has been growing at an exponential pace since the DARPA Grand and Urban Challenges pushed the state of the art to demonstrate what was already possible. Commercial interest and aggressive development are being driven by Google, Toyota, Tesla, Continental, Uber, Apple, NVIDIA, and many other companies. There is no single technology or "killer app" available to solve the myriad perception, understanding, localization, planning, and control problems required to achieve robust navigation in highly variable, extremely complex and dynamic environments. This summer, Beaver Works Summer Institute will offer nine teams of five students, each with its own MIT-designed RACECAR (Rapid Autonomous Complex Environment Competing Ackermann steeRing robot, the opportunity to explore the broad spectrum of research in these areas, and learn to collaborate, and demonstrate fast, autonomous navigation in a Mini Grand Prix to ***Move... Explore... Learn...Race****!*

This program consists of two components, all virtual: a prerequisite, online course from February to May open to all interested students and an intensive four-week virtual program from July 11 to August 7 for a select group of students. The prerequisite component gives students a background in the basic concepts and tools that will be used during the summer program. Students will learn a rich set of modern tools and techniques used in the world of robotics. Students will also have the opportunity to program a simulated RACECAR in Unity, which will allow them to develop skills and demonstrate the basic concepts without requiring a physical RACECAR.

Completing the prerequisite curriculum will prepare students to cover the topics of Control Systems, Computer Vision, Localization, Planning, and Navigation at a more advanced

level in the virtual summer program. The robotic platform used in the course is the RACECAR Model Nano (RACECAR-MN, which is capable of achieving speeds of 30 mph, utilizing data from real sensors processed with an onboard NVIDIA Jetson Nano embedded computer. The RACECAR-MN is a small-scale, MIT-designed robotic system. Beaver Works will lend out a complete RACECAR-MN hardware kit to students who are accepted into the program, to participate in the virtual RACECAR summer program. Students will receive all of the hardware and materials required to participate in the course from their own homes.

A team of experienced MIT researchers and instructors will give live lectures, covering material on autonomy fundamentals and expanding on advanced topic areas in the lecturers' expertise. A series of graduated exercises, hands-on labs, and weekly challenge demonstrations will be provided to lead students through the process of developing their solutions to the fundamental problems. Additionally, guest lecturers from leading researchers in the computer science, engineering, and autonomous vehicle academic and corporate communities will provide students with insight into emerging trends in these fields. The instructors will be available throughout the program to help with debugging.



RACECAR model navigating simulated Unity level, using synthetic sensor data

Prerequisite Course

The online component for the Autonomous RACECAR course contains important introductory material to provide students with the background required to successfully complete the four-week summer course. The online course will contain all the necessary information for downloading and installing any needed tools or software. This course will prepare students to work through both the introductory and more advanced topics and explore problems specific to autonomous vehicles during the summer portion of the program.

Introduction and Prerequisites

- Installing and running Python
- Installing and using the virtual RACECAR Unity environment
- Overview of the Ubuntu/Linux environment
- Learning the basics of Python programming
- Introduction to the Robot Operating System

Autonomous Vehicles

- Using the RACECAR model in the Unity simulation environment
- Learning about basic control systems and basic perception
- Studying fundamentals of computer vision using the OpenCV library
- Acquiring elementary navigation and planning concepts

Summer Virtual Course

The four-week summer program is based on the BWSI 2020 course, with additional online material that prepares students to begin the summer course at a more advanced level. The curriculum is being expanded this year to emphasize the use of computer vision and machine learning techniques in autonomous navigation.

Each day in the course will consist of a mix of lectures and hands-on projects to reinforce and apply the material. The tentative schedule for each week is listed below:

Week 1: Setup…

- Meet the Instructors and TAs
- Setup your computers for virtual lectures
- Setup your computer to run RACECAR software
- Setup and test your RACECAR-MN

Week 2: Move…

- RACECAR-MN system operation and sensors
- Basic sensing and perception
- Basic motion control and simple obstacle avoidance

Week 3: Explore…

- Color- and depth-image Computer vision techniques
- Visual and inertial navigation
- LiDAR navigation

Week 4: Learn…

- Mapping unknown environments
- Planning paths to achieve goals
- Navigating in dynamic environments

Week 4 (End): Final Project/Competition!
At the end of the program, you will take part in a final project or competition, as facilitated by the instructors. This will give you a chance to expand on what you knowand share what you've learned with your classmates across the country!

MIT Beaver Works Summer Institute

2022 Summer Program

Autonomous RACECAR Remote Challenge – Field Site Locations

Marshall Islands Program

MIT Lincoln Laboratory field site on the Kwajalein Atoll in the Republic of Marshall Islands (RMI) will host an in-person BWSI mini-RACECAR program for Summer 2022. This program is open to residents of Kwajalein and local RMI high school students.

This in-person program will take place as allowed under local RMI guidance on COVID-19 protocols.

Huntsville, Alabama Program

MIT Lincoln Laboratory Huntsville Field Site in Huntsville, AL will be hosting an in-person / hybrid course for local area students.

The in-person program will take place as long if the rules for social distancing due to COVID 10 change. The virtual program will its place if the rules do not change.

MIT Beaver Works Summer Institute

2022 Summer Program

Autonomous Cognitive Assistant

Program Overview

Artificial intelligence research has achieved a dramatic resurgence in recent years, as innovation of novel deep learning and other machine learning tools has enabled machine performance surpassing humans in specific cognitive tasks. New records in “machine thinking” seem to be set almost daily. This summer, the BWSI is offering students a chance to learn and use the state-of-the-art machine learning tools in a program called Cog*Works: Build your own Cognitive Assistant. The program will guide students in learning and applying the foundational technologies of artificial intelligence for building cognitive assistants. Students who have successfully completed the online course will be considered for participation in the summer program in which teams of students will leverage professional cognition services (e.g., Amazon Alexa/Echo) and open-source tools in conjunction with their own machine learning tools to develop cognitive systems. The program will be divided into modules during which students will implement and explore algorithms in core areas of natural language processing and machine cognition. These capabilities will be composed to create end-to-end cognitive assistants that will compete against each other at the end of the program.

This program consists of two components: (1) online course from February to May 2022, open to all interested and committed students, and (2) a four-week virtual summer program for a small group of students, July 11 to August 7. During the course, the students will be trained to understand the basics of Python, Git, natural language processing, and machine learning through a series of online teaching modules. Students will build services that are both functional and fun. By participating in the online and/or onsite portion of the program, students will develop experience in an area of computer science that is poised to play a critical role in shaping future technologies and applications across many industries.

Online Course

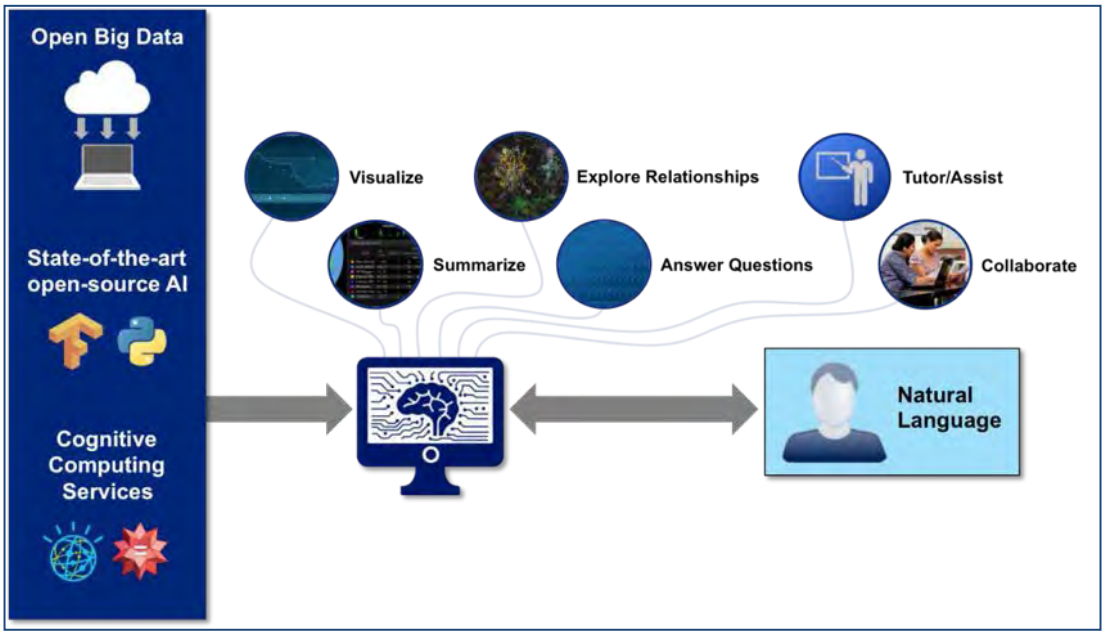
The online component for the Cog*Works course will contain important introductory material that will provide students with the background required to successfully complete the four-week summer course. In addition to the introductory material, the online course will include more advanced machine learning–specific material that will enable students to begin exploring problems specific to cognitive assistants.

Introduction and Prerequisites

- Introduction to Python
- Git & Github management tools
- Perspectives on machine learning

Autonomous Cognitive Assistants

- Advanced NumPy
- Simple image classification with Python
- Introduction to neural networks
- Introduction to Web Services
- Introduction to Microsoft Cortana©, and Amazon Alexa© services



Summer Course

The four-week summer component of the BWSI Cog*Works course aims to guide students through the process of creating their own cognitive assistants. Daily lectures from course instructors and guest speakers will solidify and expand upon the content from the online portion of the course. Students will collaborate in small groups to complete milestone projects that are based on their lecture materials. These projects will allow for creative customization and enhancements from the students, and weekly awards will be given to the group(s) with the most "interesting" projects. Ultimately, these projects will serve as the components that compose an end-to-end cognitive assistant.

The following is a rough outline for the summer course:

Week 1: Audio

- Python/NumPy/Github review
- Audio recording, sampling, and encoding
- Discrete Fourier transforms and their applications
- Pattern recognition in audio data
- Audio capstone project

Week 2: Visual

- Review of machine learning concepts
- Coding your own autograd library
- Training dense neural networks
- CNNs and RNNs
- Visual capstone project

Week 3: Language

- Representing written language numerically
- Document comparison and summarization
- Training a language model
- Training word embedding
- Information retrieval
- NLP capstone project

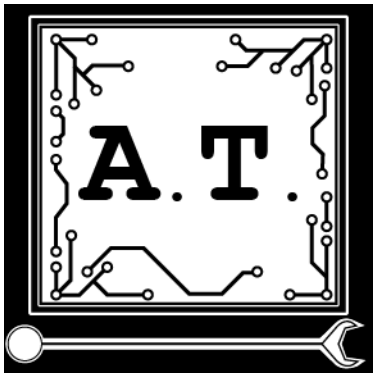
Week 4: Challenges

- Customize your own neural network

MIT Beaver Works Summer Institute

2022 Summer Program

Designing for Assistive Technologies (AT)



Program Overview

There are many members of our communities who live with physical and cognitive disabilities, some of whom may be helped by assistive technologies (AT). However, these technologies often need to be customized for the individual, making it difficult to simply use off-the-shelf products. This course will help students develop skills in product design, rapid prototyping, and product testing in a user co-design manner to understand how to produce these kinds of solutions.

We will first go over product design processes and exercises in general, and then bring those skills into the context of working in the assistive technology space. In this class, a “co-designer” is a member of the community who is living with a disability and has an idea for a technology that might improve their quality of living by easing an activity that is frustrating. Using example problems and working with co-designers, we will learn how to conduct interviews to develop product requirements, and how to develop those requirements into prototypes. With early prototypes, we then look at how to iterate over different designs, taking user feedback into account in order to arrive at solutions that work well for the end-user.

Online Course

Before the summer course, students will be required to complete an online course introducing assistive technology, product design, and specific technical skills. The course will introduce students to key concepts that will be required on day one. The latter portion ofthe online course will be an open-ended design activity that will lead students to prepare a co-design proposal that will form the core of their application to BWSI.

The online course will consist of the following modules:

- What is assistive technology?
- Design thinking
- Design processes
- Technical skills development
- Co-design proposal formation activity

Summer Course

The four-week summer component of BWSI AT will give students a chance to use and further develop the skills they learned through the online course and to iteratively improve upon their proposal until it becomes a fully developed and usable prototype. The course will have online lectures, hands-on design exercises, small group technical mentorship, and project management activities culminating with students documenting and developing a custom AT solution for a community member with a disability.

A team of MIT researchers and students will help students through these materials and activities, using previous AT solutions developed at MIT as guiding examples and helping facilitate community member engagement. By the end of this course, students will have developed an understanding of the engineering process that it takes to build an AT solution, be able to identify engineering requirements from user interviews, be able to identify potential solutions and the skills required to implement the solutions, and build their own prototype solutions.

This course is being offered virtually for the first-time during summer of 2020 and is being adjusted from the previous in-person offering. The focus of the technology skills component will depend on the needs of each student's project and is subject to change, but may include areas such as computer-aided design, 3D printing, and electronics. Past projects that have come out of a similar MIT class and hackathon have included all-terrain walkers, jackets that can be zipped up with one hand, a device to control smartphones using sip-and-puff breath inputs, and others.

Week 1: Proposal to Project Plan

- Overview of the co-design process: beginning to end
- Scoping a project with limited time and resources
- Working with people with different disabilities and cultures
- Interviewing users and identifying requirements
- Rapid prototyping using basic materials
- User testing for iterative improvement
- Agreeing on and articulating project goal (which person doing which activity in which context)

Week 2: Systematic Ideation and User-Testing Prep

- Starting lab notebook to document design
- Searching for off-the-shelf solutions
- Brainstorming ideas
- Examining proposed solutions and required skills
- Build and share low-fidelity proof-of-concept and user-testing plan

Weeks 3: User Testing to Create Prototype

- User testing with low-fidelity prototypes
- Tweak, rebuild, refine, reevaluate
- Incorporate all testing into final design
- Order parts

Weeks 4: Build, Document and Share Prototype

- Build final design
- Prototype testing and evaluation by co-designers
- Finish documentation
- Prepare final report/presentation

MIT Beaver Works Summer Institute

2022 Summer Program

Build a CubeSat

Program Overview

In 2022, this BWSI course is dedicated to space but grounded in science. The course will partner with Woods Hole Oceanographic Institution (WHOI) to tackle a real-world ocean science mission. Based around a 1U CubeSat (10 cm x 10 cm x 10 cm), the four-week course will guide the class through the design trades, assembly, and testing of a CubeSat with an imaging payload. The program will consist of two components. The first is a series of online courses teaching the basics of satellite development coupled with computer-driven exercises that will allow the class to perform key design trades for the mission involving communication, power generation and usage, size, mass, and performance. The four-week summer program will review the key points from the online course and add in lessons on how to handle and test hardware before assembling and testing a working CubeSat prototype. During the summer course, students will work with Lincoln Laboratory staff and MIT graduate students to gain hands-on experience inbuilding a space system.

The progression of miniature electronics coupled with the availability of launch rideshares provides access to space for a wide range of organizations that weren't able to dream of such capability 20 years ago. The advent of the CubeSat standard by Bob Twiggs and Jordi Puig-Suari in 1999 opened up real, achievable access to space for student projects that allows forhands-on development experience for the next generation of scientists and engineers.

Online Course

The online component for the BWSI CubeSat course contains important introductory material toprovide students with the background required to successfully complete the four-week

Introduction and Prerequisites

- Why we go to space?
- Basics of rockets and orbital dynamics (using Systems Toolkit)
- Spacecraft subsystems

Satellite Design Work

- Spacecraft systems design trades
- The space environment
- Satellite engineering tools
- Laboratory safety

Summer Course

The four-week summer component of BWSI CubeSat will focus on building and testing spacecraft hardware. Daily lectures will review the basics with the students, and guest lectures on key spacecraft systems will be given. With hardware kits at home, students will split into teams to get hands-on exposure to hardware testing, assembly, and programming. Students will be mentored by Lincoln Laboratory staff, and MIT faculty and graduate students, and WHOI engineers and scientists.

The following is a rough outline for the summer course:

Week 1: "Space, The Final Frontier" Hardware Basics and Systems Engineering

- Space systems 101
- Basic hardware safety and handling
- Fundamentals of systems engineering

Week 2: Spacecraft Subsystems

- Testing and assembly of all subsystems
- Payloads and camera performance
- Communication and power
- Software, the glue that holds it all together

Week 3: "Houston We Have A Problem" Making It All Work Together

- Subsystem integration
- System and software testing
- Mission planning, attitude determination
- Debugging and testing a flight system

Week 4: Test Flights and Analysis

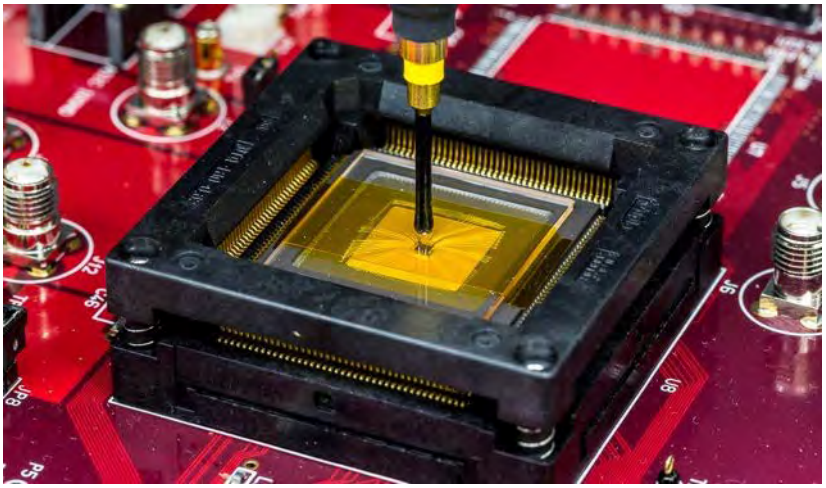
- Final functional testing
- Simulated "flight"
- Evaluate mission performance

MIT Beaver Works Summer Institute

2022 Summer Program

Embedded Security and Hardware Hacking

MITRE Project



Program Overview

Most of us are aware of our reliance on computers throughout our everyday lives, but what we typically think of as computers (from the servers that run our favorite websites, to our laptops and smartphones) are only the tip of the iceberg. Hidden just beneath the surface isa substantial and diverse group of computers referred to as embedded systems. Although the concept may be unfamiliar to many, embedded systems are pervasive and have existed for decades. They commonly work within larger pieces of technology, performing specific tasks, such as operating one element of a car, medical device, aircraft, or even a musical instrument. Their security affects the security of the larger system. And they are being hacked!

This program consists of two components: an online course from February to May open to all interested students, and a four-week virtual summer program from July 11 to August 7 for a select group of students.

The online course will introduce the students to several security topics with a focus on threats that are especially concerning for embedded systems. These topics include embedded software security, JTAG and UART probing, side-channel analysis, and fault-injection. This background will help prepare students for the summer course, during which they will design and perform security assessments of multiple implementations of an embedded system. They will learn the basics of embedded security and hardware hacking by designing a secure system and performing security assessments of classmates' designs to see who can find and fix the most security flaws.

Online Course

The online component for the Embedded Security and hardware hacking course contains important introductory material to provide students with the background required to successfully complete the four-week summer course.

The online course will consist of the following modules:

- Hardware
- Embedded Software
- Programming in Python
- C programming
- Assembly
- Cryptography Basics

Summer Course

The four-week summer program is based on the MITRE Collegiate eCTF, which challenges teamsof undergraduate and graduate students to design a secure system. Teams of BWSI students willdesign and implement their own secure systems based on a previous eCTF challenge and then hunt for security flaws in other teams' designs. The course will consist of a mix of lectures and hands-on labs and projects that reinforce and apply the material. The detailed topics for each week are listed below:

Week 1: Embedded Software

- Components of embedded systems
- Embedded software security basics

Week 2: Cryptography and Security

- Overview of cryptography and secure design fundamentals
- Introduction of the design challenge

Week 3: Hardware Analysis

- Hardware and interface analysis
- Introduction to side-channel analysis and fault attacks

Week 4: Hack!

- Teams will compete to see who can score the most points – earned by capturing virtual "flags",by demonstrating flaws in the target systems, and by fixing the flaws to secure the system.

MIT Beaver Works Summer Institute

2022 Summer Program

Medlytics

Program Overview

Data mining and machine learning have become ubiquitous in the age of "big data," and for good reason: advanced learning algorithms take advantage of ever-growing compute capacity and vast amounts of data to solve complex problems that can often meet or exceed human ability. These techniques are being embraced in nearly every sector including financial trading, cybersecurity, entertainment, advertising, autonomous vehicles, and of course health and medicine. The increasing adoption of electronic health records, mobile health apps, and wearable technologies continues to generate troves of rich, real-time, high-resolution data. This data is now being used to train algorithms to help physicians build prognostic models, conduct medical image analysis, and improve diagnostic accuracy.

In, the BWSI Medlytics program will offer students the opportunity to explore the exciting intersection of data science and medicine. The program consists of two components: (1) online course from February to May, open to all interested and committed students; and a four-week virtual summer program hosted by MIT for a group of 20-25 students from July 11 to August 7. The online course will help students build a solid foundation in the fundamentals of probability and statistics, and provide an introduction to coding and machine learning techniques through a series of online teaching modules. During the summer, students will work in groups to gain hands-on experience applying advanced machine learning and data mining to solve real-world medical challenges.

Online Course

The online component for the BWSI Medlytics course contains important introductory material to provide students with the background required to successfully complete the four-week summer course. In addition to the introductory material, the online course will expose students to real-world data and machine learning techniques, and introduce some of the challenges and opportunities of combining the two.

Introduction

- Perspectives on the challenges of working with medical data
- Probability & statistics
- Introduction to coding: Python, Git, Jupyter

Data Science for Health and Medicine

- Defining a patient cohort
- Correlation and regression; noise vs. outliers
- Beginner machine learning: supervised and unsupervised algorithms
- Introduction to time series data analysis

Summer Course

The four-week summer component of Medlytics will take a deep-dive into the application of data analytics to structured data, physiological signals, and medical imagery. Prepared course material, case studies, and small-group projects will expose students to some of the challenges inherent to working with medical data and introduce them to state-of-the-art machine learning tools. Students will compete in weekly challenges and participate in a final capstone project from concept proposal to live demonstration.

The following is a rough outline for the summer course:

Week 1: Introduction to Diagnostic Research and Machine Learning

- Research questions, hypotheses and objectives
- Structured data processing and plotting in Python
- Classification evaluation and metrics
- Supervised machine learning
- Clinical Data Challenge 1: Diagnosing Hypothyroidism

Week 2: Signals Processing and Deep Learning

- Introduction to signals processing
- Fourier transforms
- Machine learning for time-series data
- Artificial neural networks
- Clinical Data Challenge 2: Classifying Sleep Stages

Week 3: Image Processing and Advanced Data Analytics

- Computer vision applications in medicine
- Texture classification using convolutional neural networks
- Transfer learning
- Clinical Data Challenge 3: Analyzing Mammograms

Week 4: Capstone Project

In the final week of the course, students will work in teams to propose, design, and demonstrate a health application prototype, leveraging the lessons learned from weeks 1-3.

MIT Beaver Works Summer Institute

2022 Summer Program

Remote Sensing for Disaster Response

https://www.af.mil/News/Article-Display/Article/116782/rescue-center-members-assist-with-saving-330-lives-in-tennessee/

Program Overview

Imagine coordinating a response after the chaos of a hurricane or the challenges of a famine lasting years, these big problems require big data to solve. With airplanes and satellites, we collect mountains of data of affected regions but who looks at this data? How do we turn this data into a physical response? The program's goal is for participants to explore, leverage, and transform open source information and imagery collected from drones, airplanes, helicopters, and satellites to generate actionable intelligence to support a disaster or humanitarian response. Students will be exposed to three main components:
(1) remote sensing modalities and data products, (2) visualization and analysis technique with AI and machine learning (AI/ML), and (3) using data for decision making. The program will explore tools and techniques using real world operational data from across the globe.

In 2022, this BWSI Remote Sensing program will offer students the opportunity to explore the exciting intersection of data science and disaster response. The program consists of two components: (1) online course from February to May 2022, open to all interested and committed students; and (2) a four-week virtual summer program. During the course, the students will learn to understand the basics of Python, Git, GIS, machine learning, and image processing through a series of online teaching modules. Students will explore real world datasets featuring disaster imagery from both satellites and aerial platforms. Students in this course will develop experience in an area of data science that is poised to play a critical role in understanding our world.

Online Course

Prior to the virtual summer course, students will be required to complete an online course which contains important introductory material. The online course will give the students a strong foundation required to successfully complete the four-week summer course. In addition to foundational introductory material, the online course includes discussion of different use cases and expose students to real world challenges and applications of the coursework.

Introduction and Prerequisites

Computer Science	AI/ML and Data Science	Real World Data
• Python	• GeoPandas and GIS	• Civil Air Patrol
• Git & GitHub management	• Intro to Deep Learning	• Social Vulnerability
• Machine learning ethics	• Image Processing	• Satellite Imagery

Summer Course

The four-week summer component of aims to guide students through the processing of designing experiments to evaluate primarily text-based content. Daily course material, case studies, guest lectures, and small-group projects will expose students to challenges across technical domains.

The following is a rough outline for the summer course:

Week 1: Introduction to GIS

- Review of Python fundamentals
- Introduction to pandas, geopandas, geospatial information systems
- Working with open source tools and data

Week 2: Analysis of Geospatial Data

- Introduction to classifiers and data science
- Spatial analysis and networks
- Geospatial data sources and how to work with them

Week 3: Introduction to Image Processing

- Fundamentals of images and metadata
- Multispectral imaging
- Satellite images and analysis
- Deep Learning Image classification

Week 4: Decision Making

- Intro to optimization
- Data-driven decision making

MIT Beaver Works Summer Institute

2022 Summer Program

Serious Game Design and Development with AI

Program Overview

Combine modern methods in machine learning and game-like modeling to quantitatively analyze socially relevant technology and policy questions. This year's application will be tactical routing for self-driving ambulances. We will build an analysis framework in Python to study the technical, moral, and strategic opportunities that new technologies present to that application. There will also be an emphasis on learning the practical tools and skills for working on a professional software development team.

Historical

Game depicting physical and social influences on infant health circa 1900

Modern

2019 BWSI students participating in hurricane disaster simulation

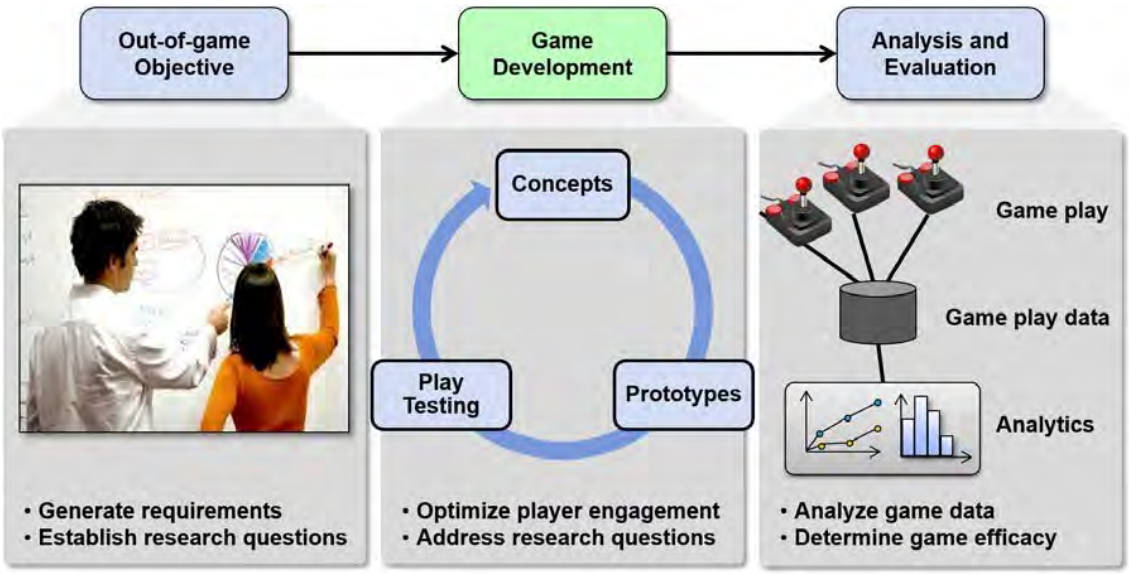
The recent interest in gaming as a method for acquiring data on human-machine interaction, decision making and human factors has helped establish an emerging area of research called “Serious Games”. Examples of Serious Games can include:

- Training for dangerous, expensive, or rare situations
- Evaluation of critical factors in decision making
- Cognitive assessment for injuries and diseases that affect the brain
- Systems analysis

Examples, such as Foldit, a game which adds to the body of bioinformatics knowledge by challenging users to fold proteins, can actually make a significant scientific impact. Output from the game helped scientists understand the inherent structure of a key protease in a virus which causes HIV-like symptoms. As personal computing platforms become more prevalent (who, today, doesn’t own a cell phone?) the opportunity to help tackle critical challenges by harvesting the brainpower of millions while generating fun is tantalizing.

The program will consist of a one-month, intensive dive into the key aspects of serious gaming including: experimental design, game design, and application development. The course will examine and categorize different types of games, how to extract useful data, an introduction to User Interface design, rules development and play testing.

Students will be provided a basic introduction to Agile management, and coached as they follow the timeline for development. Completing the course will provide students with an understanding of software development, project management, human factors, game design, and technical collaboration as well as the emerging fields of artificial intelligence and serious games.



Prerequisites:

- Python

Topics covered in this course:

- Systems modeling
- AI for gaming
- Ethics for AI
- Backend game development
- Game mechanics and input interfaces
- Human systems and user interfaces
- Data logging and data analysis
- Undead domain modelling
- Agile team and software practices

Course Outline:

Week 1

- Overview of serious games and their role in systems analysis and human factors
- Introduction to design of experiments
- Dev team formation
- Agile software development, healthy teams
- Backend software development starts

Week 2

- Backend software development continued
- Explore zombie-based automated medical response architectures
- Role and ethics of AI in game design and development
- Novel game extension to baseline game proposal
- Public health policy overview

Week 3

- Modeling undead disease propagation
- Novel game extension development
- Human Systems Interfaces, User Interface Design, Visualizing Information,
- Data logging and analysis

Week 4

- Game code finalization
- Run the experiment (play the developed game) with data collection and analysis
- Game debut
- Final presentations and results

Expectations:

Students will focus on coding both a portion of the game back-end as well as self-designed extensions. With the assistance of instructors and Teaching Assistants, participants will learn about how Artificial Intelligence can impact the design of experiments and contrast with natural, human-centric game play. All students will participate in both back-end development, within a game-ready python framework, as well as coding of their own extensions. Introduction to supporting topics, including software development best practices for small teams, how to create user interfaces, bug and issue management, data visualization, public health and disease control, and technical presentation will be included.

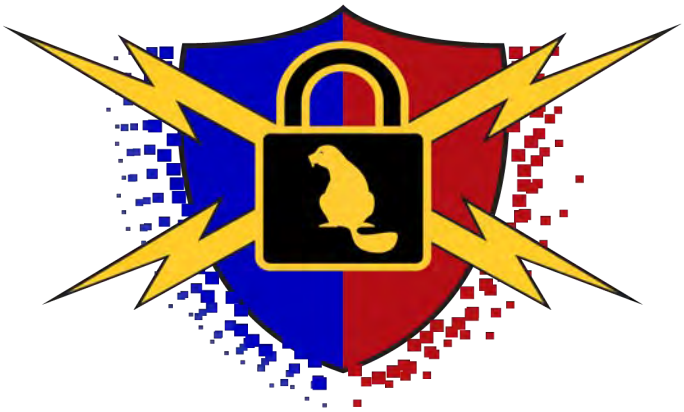
Game Theme:

A single player game, which can also be played as by committee, describes the outbreak of a highly-contagious disease threatening a densely populated, urban area. Individuals who have contracted the disease have formed a zombie population which can be categorized into different architypes. These architypes may have different capabilities, propagation models, needs, and goals. The objective of the game will be to explore the efficacy of public health policies designed to deal with traditional disease outbreaks as applied to different infection models, methods and rates. Data analysis, such as the rate of infection compared against the implementation of different human or AI-enabled policy decisions, will provide an opportunity to visualize the results of different decision-making styles in remediating the humanitarian disaster.

MIT Beaver Works Summer Institute

2022 Summer Program

Cyber Operations



Program Overview

Beaver Works Summer Institute offers students a chance to learn and apply cyber security concepts in a pilot course titled Cyber Operations. The program will introduce students to techniques for conducting full-spectrum cyber operations from: networking, system administration, cyber threat intelligence, network defense, digital forensics, malware analysis, and to offensive security. Topics & themes are routinely emphasized in layered repetition. Beaver Works invites Guest Lecturers and Subject-Matter Experts from Industry to collaborate with and to contribute field experience to the world-class education. Students operate both individually and as teams to solve complex problems via the crawl-walk-run methodology. Students are empowered to lead their peers through communication and through shared responsibility & foster comradery. This will culminate a digital field training exercise (FTX) or capstone event consisting of several mystery tasks derived from several phases of the course.

Students are individually assessed based on successful completion of phases and several dimensions (attendance, leadership, teamwork, technical competence, & lecture participation) via GO or NO-GO. The Class is also assessed based on successful majority completion of the phases and may be granted the title of "*Beaver Operator*". Teams demonstrating successful completion of the capstone will rightfully earn the coveted "Course Challenge Coin". Individuals who embody qualities of technical-competence, significant supportive teamwork, and exemplary leadership may earn the mysterious & ultra-rare "Dark Coin".

Prerequisites (Technically-Intensive Course)**:**
Python*
Bash (Linux OS)
Ability to Read ASCII/Hex/Binary
**some prerequisites can be waiver-able at the discretion of the Course Instructor & Program-Staff*

MIT Beaver Works Summer Institute

2022 Summer Program

Phases:
Pre-Phase 0 – Selection
Phase 0 – NETOPS Fundamentals
Phase 1 – DCO Basic
Phase 2 – DCO Advanced
Phase 3 – OCO (Offensive Security)
Phase 4 – Capstone
Phase 5 – Recovery

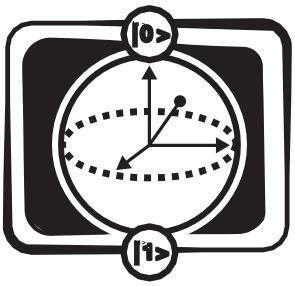
Fall:
Pending course feedback and popularity, Cyber Operations may run in the Fall 2022. Intensity is scaled-down based on available time, academic schedules, and content. Fall is an accelerated survey course in which Phases 0-4 are covered again. Those not selected for Summer are highly-encouraged to apply for this section as well. Phases are subject to change.

Spring:
Pending course feedback and popularity, intensity is scaled-down based on available time, academic schedules, and content as a preparation course for Summer. Emphasis is in Phases 0-2. Phases are subject to change.

MIT Beaver Works Summer Institute

2022 Summer Program

Quantum Computing
MITRE Project



Program Overview

Blurb: BWSI and MITRE are collaborating to offer one of the world's first quantum computing courses at the high school level. This class will help you develop practicable quantum software engineering skills and enable you to implement and analyze quantum algorithms using Q# and Qiskit. This summer, join the Quantum Revolution and learn how to harness this disruptive technology!

Summary

In recent years, there has been an enormous surge of interest in quantum computing. Government, academic, and commercial organizations have spent billions of dollars attempting to create reliable, general-purpose quantum computers. These systems leverage the unusual properties of quantum mechanics to perform computations that could never be performed on conventional computers in our lifetime. Such calculations have a wide range of applications, including:

- Breaking certain cryptographic algorithms
- Engineering new materials
- Simulating how systems behave in extreme environments
- Finding new medicines that target specific diseases
- Building secure transmission channels that cannot be eavesdropped

MIT Beaver Works Summer Institute

2022 Summer Program

How do quantum computers accomplish these bold claims? How could we use this technology to tackle our most difficult challenges? And how do programmers like you access it? In this course, we will explore the answers to these questions and help you

unlock the ability to write quantum software and simulate quantum algorithms. Students should bring some basic programming experience and an open mind as we delve into a new computing paradigm.

Prerequisites

The prerequisite knowledge and skills required to excel in the summer course will be covered in online materials available to students between February and June. This portion touches the following topics:

- Complex numbers
- Vectors & Matrices
- Bra-ket and tensor notation
- Digital information
- Endianness
- Digital logic
- Low- and high-level programming
- Visual Studio

Outline

The objective of the summer is to develop the practicable skills needed to implement and study quantum algorithms in software. In the first half of the course, students will learn the fundamentals of quantum computing through live lectures interspersed with lab exercises in Visual Studio. During this portion, the following topics are covered:

- Qubits and quantum gates
- Multi-qubit systems
- Quantum circuits
- Quantum protocols
- Quantum algorithms
- Quantum error correction
- Execution on quantum hardware
- Q# and Qiskit programming

In the second half, students will break out into teams of 3-4 to design their own software implementations of a quantum algorithm. Each team will select an algorithm from the literature, work together to understand how it works, develop a quantum program that implements it, verify the correctness with unit tests, analyze the computational resources required to run the program, and finally create a video explaining their work to a general audience. (See the results of the 2021 program on YouTube.)

MIT Beaver Works Summer Institute

2022 Summer Program

Autonomous Underwater Vehicles Challenges

Program Overview

Many of the final frontiers of exploration on Earth are underwater – the deep ocean, water-filled cave systems in the Yucatan Peninsula, and the subglacial lakes of Antarctica. Exploring the farthest reaches of these areas requires underwater piloted or semi-autonomous vehicles. Hydrodynamic pressure, water currents, darkness, curious sea creatures and slimy bacteria make underwater places difficult to navigate. True underwater autonomy is difficult to achieve, and even the most advanced piloted vehicles are frequently lost.

This course will introduce students to the challenges faced by real-word ocean engineers in designing, building and programming autonomous underwater vehicles (AUVs).

The culmination of the course will be an exciting test of true autonomy – the student AUVs will autonomously navigate simulated underwater obstacle course, applying real-time decision making based on feedback from onboard sensors.

Prerequisites

- Python
- Physics (any level)
- Linear algebra (any level)

Course Topics

- Vehicle control
- Sensor integration
- Data analysis
- Image processing
- Autonomy

Summer Course Outline:

Week 1
- Introduction to marine autonomy
- Setting up computing environment
- Foundational tools – Linux Command Line, Vim, C++, Visual Studio Code

Week 2
- Single-vehicle autonomous operations
- Mission analysis
- Writing your own sensor-driven behavior
- Individual project

Week 3
- Multi-vehicle autonomous operations
- Individual challenge problem
- Final challenge team formation

Week 4
- AUV Final Challenge execution

MIT Beaver Works Summer Institute

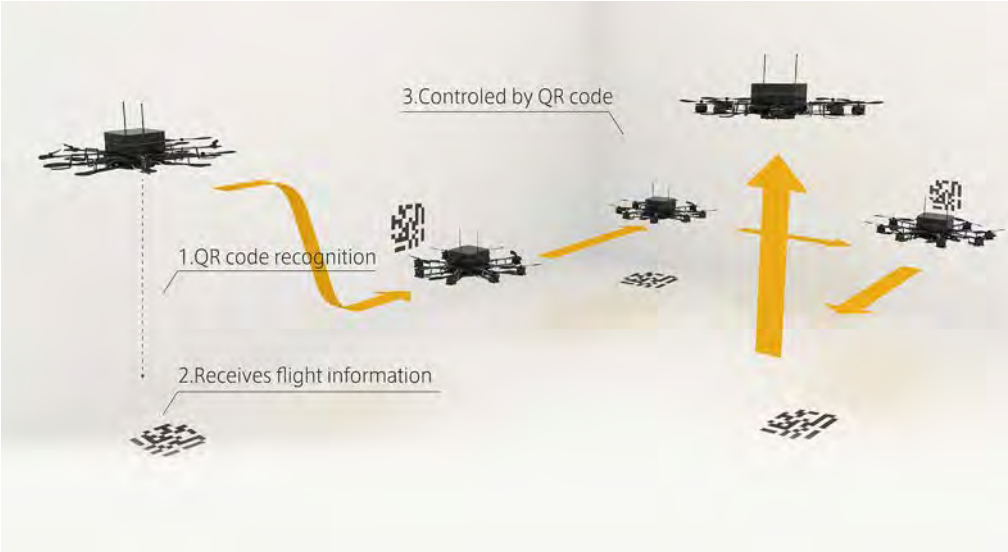
2022 Summer Program

Autonomous Air Vehicle Racing

Program Overview

Rapidly expanding unmanned aerial vehicle (UAV) technology has enabled a number of new application areas. The growth in UAV development is evident in the popularity of First-Person View (FPV) drone racing, and interest from companies, like Amazon and others, to develop fully autonomous aerial delivery vehicles. As UAV technologies mature, they open new and exciting areas for potential research. This summer, Beaver Works will offer students the opportunity to explore some of these new areas of research, and to design their own autonomous capabilities for UAVs. The students will work in teams to develop algorithms for deployment of a commercial quadrotor, the DJI/Ryze Tello drone. They will use Python, Robot Operating System (ROS), various open-source libraries, and custom algorithms to program the quadrotors. The summer course will culminate in a final challenge during which the students will apply the knowledge gained from the four-week program's projects and lectures to an autonomous navigation project.

This program consists of two components: an online course from February to May open to all interested students and a four-week summer program at MIT from July 11 to August 7 for a small group of students. The online component gives students a background in the course material, and provides a solid foundation in programming that will be critical when completing the more advanced topics of the summer course. Students will demonstrate basic implementations of control and autonomy after each unit of instruction. These lessons will build upon previous instruction to enable students to develop algorithms so that their quadrotors can autonomously navigate through their homes.



Conceptual UAV QR Navigation

Online Course

The online component for the Autonomous Air Vehicle Racing course will contain important introductory material that will provide students with the background required to successfully complete the four-week summer course. In addition to the introductory material, the online course will include more advanced, quadrotor-specific material so that students can begin to explore problems specific to autonomous aerial vehicles.

Introduction and Prerequisites

- Introduction to quadrotors
- Linear algebra
- Basics of matrix mathematics
- Introduction to probability and statistics
- Computer programming fundamentals

Autonomous Aerial Vehicles

- Flight geometry
- Actuators and control
- State estimation
- Sensing
- Basic control theory
- Computer vision
- Visual motion estimation

Summer Course

The four-week summer program will be structured to provide the students with projects and hands-on exercises. The program will apply and expand upon the online course material, leading to multiple competitive team challenges in autonomous UAV control. Each day the course will consist of a mix of lectures and hands-on projects to reinforce and apply the material. A team of experienced MIT researchers will provide the lectures, covering material that reviews UAV and autonomy fundamentals and expanding on advanced topic areas in the lecturer's expertise. Hands-on projects will enable the students to apply each lecture, working toward a capability for autonomous UAV navigation by using the provided drone and associated equipment. In addition, the course is lining up guest lecturers from among

leading researchers in the computer science, autonomy, and air vehicle academic and corporate communities to provide the students with emerging trends in these fields. Upon completion of the four-week course, the students will have developed an understanding of autonomous systems development; including controls, flight dynamics, navigation, and computer vision.

The summer course extends over three weeks of instruction and hands-on practice and one week of team challenges, culminating in the final UAV racing challenge. The detailed topics for each week are listed below:

Week 1: Quadcopter Basics

- Intro to Unix, Debugging, Git
- UAV Hardware & Safety
- Robot Operating System
- Localization & Reference Frames

Week 2: Computer Vision & Machine learning

- Intro to Computer Vision
- Edge Detection & Color Segmentation
- AR Tags & Intro to Probability
- Machine Learning & Applications in Computer Vision

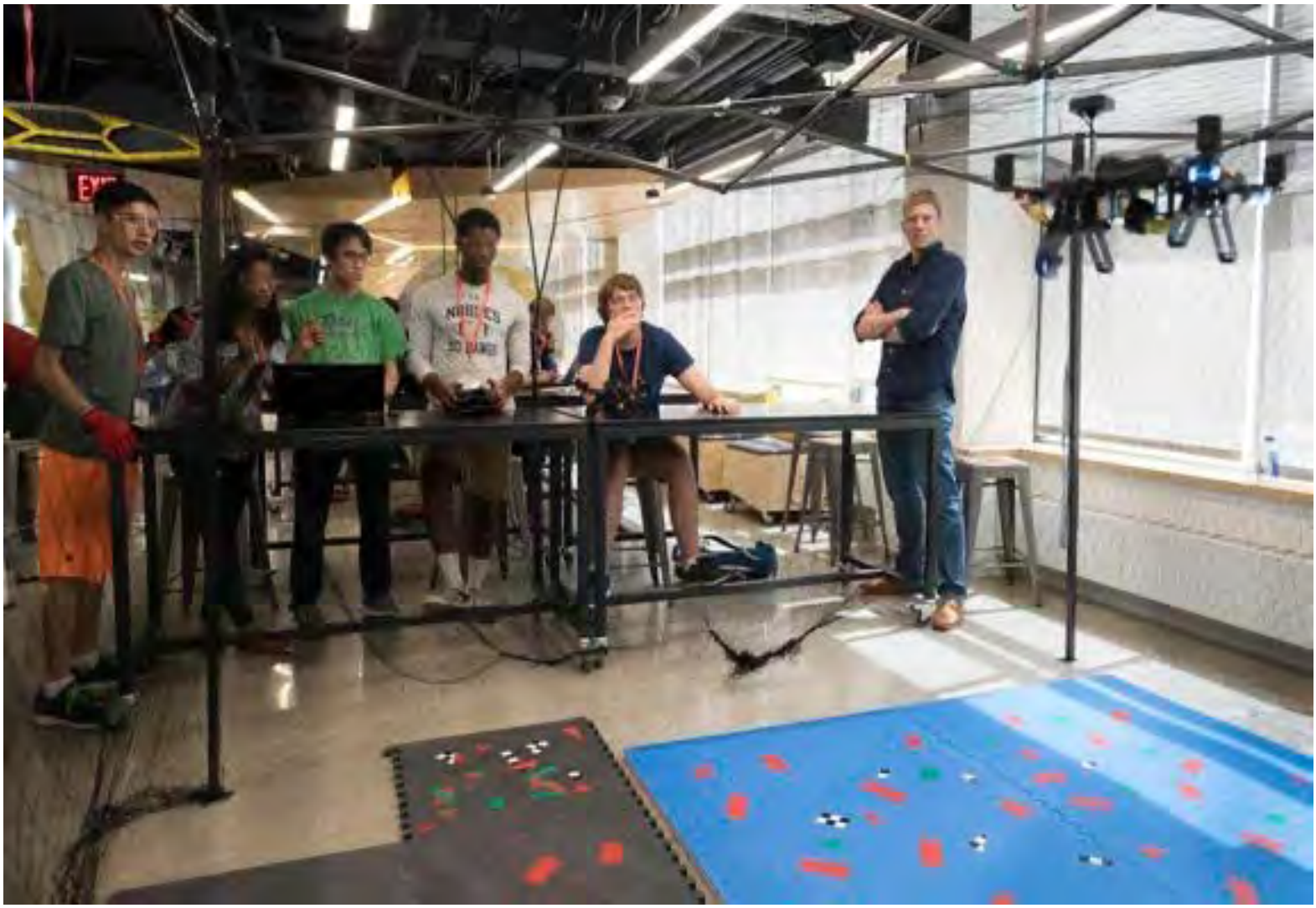
Week 3: Planning & Control

- Intro to Control Theory
- State estimation
- Navigation and planning

Week 4: Final Challenge

The final week of the course will focus on hands-on team projects in autonomous UAVs and autonomous navigation challenges, leveraging the lessons learned from the first three weeks of the course.

BEAVER WORKS
Lincoln Laboratory | School of Engineering



MIT Beaver Works Summer Institute

2022 Summer Program

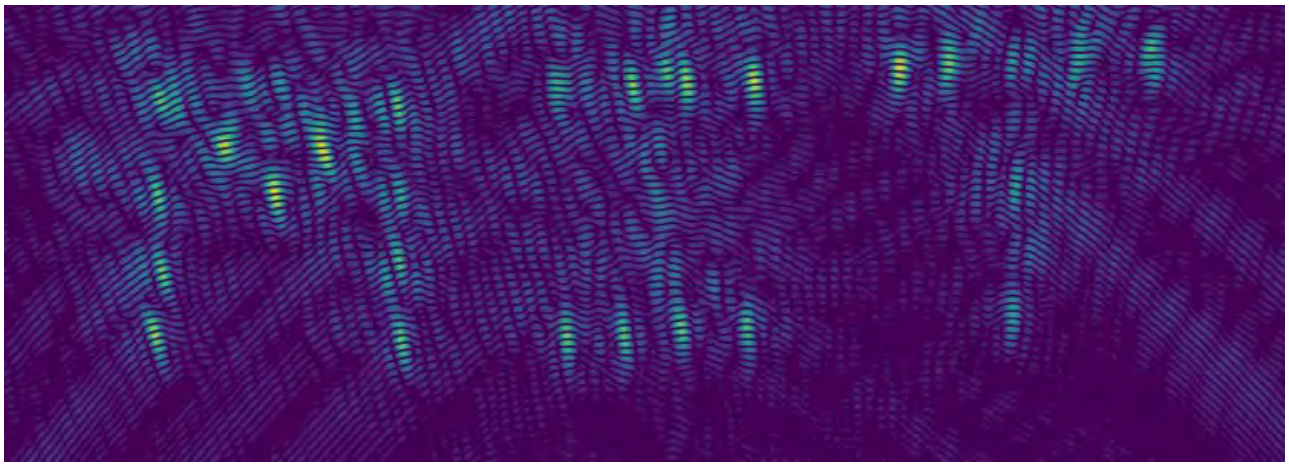
Unmanned Air System - Synthetic Aperture Radar

Program Overview

The recent explosion of unmanned air system (UAS) technology coupled with the miniaturization of electronics opens the door to countless applications and missions. UAVs can provide unparalleled views at sporting events, images of structures are not safely accessible to construction workers, and scenic aerial photography, all using low-cost camera technology. One can also envision many applications of small UAS-based radar solutions, ranging from day/night autonomous tracking of objects of interest in all–weather conditions to change detection using radar imaging techniques to search and rescue.

In 2022, the BWSI Unmanned Air System – Synthetic Aperture Radar (UAS-SAR) program will offer students the opportunity to explore the field of radar imaging by simulating a radar on a small UAS and using it to image a virtual world. The program consists of two components: (1) a preparatory course from February to May 2022, open to all interested and committed students, and (2) a four-week summer program for a small group of accepted students from July 11 to August 7. The preparatory course will help students build a solid foundation in the fundamentals of radar, basics of Python programming, and collaboration tools such as Git. During the summer, students will work in small teams of 4 – 5 alongside instructors to implement command and control of a commercial radar, develop radar imaging software, conduct simulated data collections, perform data analysis to identify and address problems, and extend their UAS-SAR system w/ novel capabilities.

UAS-SAR System in Operation



SAR Image of "MIT" formed by Student Team

Online Course

The preparatory component for the BWSI UAS-SAR course contains important introductory material to provide students with the background required to successfully complete the four-week summer program. In addition to the introductory material, the online course will expose students to real-world radar data and UAV motion properties.

Introduction and Prerequisites

- Introduction to Python
- Introduction to Numpy, Matplotlib, and other required Python packages
- Git and GitHub collaboration tools

Radar

- Fundamentals of radar
- Radar system components
- Ranging with a radar
- Doppler effect

Summer Course

The four-week summer component of the UAS-SAR course will feature a mix of lectures from radar experts, team-based system development, and simulation-based experiments with mini-capstone milestones at the end of each week. Lectures w/ active student participation will reinforce basic radar concepts and dive deep into the principles behind radar imaging. Students will conduct simulation-based experiments by defining experiment objectives and plans, executing said plans, and performing analysis on the collected data. They will also learn how to interpret radar imagery in order to assess success and areas for improvement in their systems.

Week 1: Let's Build a Radar

- Python review
- Radar fundamentals review
- Implement radar command and control
- Milestone: Ranging and Doppler experiments w/ show-and-tell

Week 2: Let's Form an Image

- Introduction to SAR imaging
- Implementing SAR via back projection
- Rail-SAR experiments
- Milestone: Best SAR image challenge

Week 3: Up, Up, and Away

- Integration of radar onto UAS
- UAS-SAR data collections
- Refining SAR imaging algorithms
- Milestone: Best UAS-SAR image challenge

Week 4: Best Image

- Teams refine/improve their UAS-SAR
- Team develop novel capabilities for their UAS-SAR
- Teams compete to form the best image of a secret challenge scene

BWSI Online Program Application Process for High School Student

In 2022 BWSI hosted all our courses virtually.

- Autonomous RACECAR Grand Prix
- Build a Cubesat
- Designing for Assistive Technologies
- Embedded Security and Hardware Hacking
- Medlytics
- Quantum Software
- Autonomous Air Vehicle Racing
- Cog*Works: Build Your Own Cognitive Assistant
- Cybersecurity in Software Intensive Systems
- Remote Sensing for Disaster Response
- Serious Games Design and Development with AI
- Underwater Autonomous Vehicle Challenge
- Unmanned Air System - Synthetic Aperture Radar

To be eligible to apply to one of these summer programs, you must complete the BWSI Pre-requisite Online Education Program, designed to prepare students for the technically rigorous BWSI summer programs.

To participate in the online pre-requisite course, we have two tracks that can be followed:
For up-to-date links see our website: https://beaverworks.ll.mit.edu/CMS/bw/bwsiapply

Track 1: If you are a Teachers/Parents/Guardian/Mentors (TPGM) you can nominate student(s) with step below:

Step 1 for TPGM - Nominate the student(s) for access to the online course.

Courses do not open until 1 February - students will not have access until then but register students early so they can be ready to go. Nominations for registration is continuous to 31 March, after that date, students can still be nominated but will only be eligible to take the online courses.

Teachers, prior BWSI students, and teaching assistants (TAs) can also apply for online course access by using the same link that the students use to apply to the online program

Step 2 Student Registration: After nomination, the student will be sent a link to register themselves for access to the free online course

Students will receive their unique ID number after they complete and submit their registration for the online course. Students will also need to self-register on Piazza to be able to participate in the course Q&A forums, all piazza information will be found in the online courses. All online courses will remain open for independent learners, even if they are not accepted into the July program

Track 2: Students can register themselves for online pre-requisite course access

Nominate yourself for access to the online course (learn.bwsix.edly.io), see https://beaverworks.ll.mit.edu/CMS/bw/bwsiapply for current link

Once you have completed the form, you will be sent information to enrolling in the online courses.

BWSI Virtual Summer Program Application Process

Application for the BWSI Summer Program is separate from the online course application. The Summer Program application will be available Mid-March 2022, with decisions expected April 30 2022. The selection criteria for the Summer Program include, but are not limited to,

1. Demonstrated technical ability (determined through recommendation by school official andother supporting information, such as test scores, completed coursework, and grades collected in the application).
2. Demonstrated commitment to extracurricular learning via participation and completion of theonline course (participation/progress are tracked by the instructors).

Students must make significant progress in the online course by Summer Program application to ensure that they are ready and well prepared for participation in the BWSI programs. Students may participate in one or more of the online courses to determine which they are interested in, but note that the online courses are time-intensive, and we suggest down selecting to a single course as early as possible.

2022 Virtual Summer Program (July 11 - August 7, 2022)

MIT Advisors

Prof. Anantha Chandrakasan (Dean, MIT School of Engineering)
Dr. Melissa Choi (Assistant Director, MIT Lincoln Laboratory)
Prof. Dan Hastings (Department Head, MIT Aeronautics and Astronautics)
Prof. Asu Ozdaglar (Department Head, MIT Electrical Engineering and Computer Science)
Heidi Perry (Chief Technology Officer, MIT Lincoln Laboratory)
Prof. Daniela Rus (Director of Computer Science and Artificial Intelligence Laboratory at MIT; Deputy Dean of Research, MIT Schwarzman College of Computing; Electrical Engineering and Computer Science)
Prof. Sanjay Sarma (Vice President for Open Learning, MIT; Mechanical Engineering)
Prof. Evelyn Wang (Department Head, MIT Mechanical Engineering)

Staff

Program Coordinators

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Lisa Kelley (Beaver Works Summer Institute Manager, MIT Lincoln Laboratory)
Joel Grimm (Beaver Works Manager, MIT Lincoln Laboratory)
Jenn Watson (MIT Lincoln Laboratory)
Dan Ripin (MIT Lincoln Laboratory)
David Granchelli (MIT Lincoln Laboratory)
Anthony Zolnik (MIT Department of Aeronautics and Astronautics)

Academic Directors

Prof. Sertac Karaman (MIT Department of Aeronautics and Astronautics, LIDS, IDSS)
Scott VanBroekhoven (MIT Lincoln Laboratory)

International Collaborations

Prof. Paulo Lozano (MIT Department of Aeronautics and Astronautics; Faculty Director, MIT MISTI-Mexico)

BWSI DEI Coordinator

Roberto Martinez (MIT Lincoln Laboratory)

Outreach Coordinator

Rohan Kundargi (MIT Government and Community Relations)

Autonomous mini-RACECAR Curriculum Development

Matthew Calligaro (Microsoft)

Communication Instructor

Jane Abbott (MIT Writing, Rhetoric and Professional Communication)

Health Professional

Dr. Charmain Jackman (Health Professional)

On-Line Course Coordinators

Julie Mullen (MIT Lincoln Laboratory)
Michael Houle (MIT Lincoln Laboratory)

Media/Public Relations Coordinators

David Granchelli (MIT Lincoln Laboratory)
Erin Lee (MIT Lincoln Laboratory)
Anne McGovern (MIT Lincoln Laboratory)
Dorothy Ryan (MIT Lincoln Laboratory)

Photographers/Videographers

Glen Cooper (MIT Lincoln Laboratory)
Niki Fandel (MIT Lincoln Laboratory)
Jay Couturier (MIT Lincoln Laboratory)

IT Coordinator

John Bilodeau (MIT Lincoln Laboratory)

Publications

Rich Bushey (MIT Lincoln Laboratory)

MIT Video Productions Virtual Event Production

Clayton Hainsworth (Director, MIT Video Productions)
Rod Lindheim (Production Manager, MIT Video Productions)
Kevin Tierney (Streaming Manager, MIT Video Productions)
Barry Pugatch (Technical Director, MIT Video Productions)
Tom White (Technical Director, MIT Video Productions)
Wes Richardson (Technical Director, MIT Video Productions)
Alex Sachs (Editor, MIT Video Productions)
Tatiana O'Hanlon (Editor, MIT Video Productions)
Jerold Gelfand (Editor, MIT Video Productions)
Donna DeAngelis (Producer, MIT Video Productions)
Dawn Morton (Client Services Manager, MIT Video Productions)

Autonomous RACECAR Grand Prix
Raytheon Intelligence & Space Project

Lead Instructors

Chris Lai (Cal Poly Pomona)
Paul Thai (Cal Poly Pomona)

Instructors

Carter Berlind (Boston University)
Prof. Sertac Karaman (MIT Department of Aeronautics and Astronautics, LIDS, IDSS)

Associate Instructors

Wonjun Lee (University of Southern California, BWSI 2020 Alum)
Ainsley Ward (Cal Poly San Luis Obispo)

Guest Lecturers/Instructors

Dominic Larkin (Raytheon BBN Technologies)
Ryan Xu (Amazon)

Observers

Jabari Crenshaw (Sacramento Municipal Utility District)
Adrian Williams (Sacramento Municipal Utility District)

Autonomous Air Vehicle Racing
BAE Systems Project

Lead Instructors

Nathaniel Hanson (MIT Lincoln Laboratory)
Aryk Ledek (MIT Lincoln Laboratory)

Instructors

Matt Boyd (Boston University)
Ifueko Nosakhare Igbinedion (MIT Department of Electrical Engineering and Computer Science)

Associate Instructors

Rumaisa Abdulhai (MIT Department of Electrical Engineering and Computer Science, BWSI 2019 Alum)
Matthew Schofield (MIT Department of Aeronautics and Astronautics)

Guest Lecturers/Instructor

Prof. Luca Carlone (MIT Department of Aeronautics and Astronautics)
Prof. Kris Dorsey (Northeastern University)

Autonomous Cognitive Assistant

Lead Instructor

Ryan Soklaski (MIT Lincoln Laboratory)

Associate Instructors

Dharshini Anand (Caltech, BWSI 2021 Alum)
Henry Cen (University of California Berkeley, BWSI 2021 Alum)
Victoria Helus (MIT Lincoln Laboratory)
Kathryn Le (MIT, BWSI 2021 Alum)
James Lu (Dartmouth College, BWSI 2021 Alum)
Jacob Nelson (Carnegie Mellon University, BWSI 2020 Alum)
Adrianna Peng (Stony Brook University, BWSI 2021 Alum)

Guest Lecturers/Instructors

Vaishanavi Addala (MIT, BWSI 2019 Alum)
Zac Hatfield-Dodds (Research Technical Staff at Anthropic)

Special Students

Bhargav Panguluru (Georgia Tech, BWSI 2021 Aluml)
Hyojae Park (Sharon High School, BWSI 2021 Alum)
Laya Srinivas (University of Dallas, BWSI 2021 Alum)

Remote Sensing for Disaster Response

Lead Instructor

Jeffrey Liu (MIT Lincoln Laboratory)

Instructor

Katherine Picchione (MIT Lincoln Laboratory)

Associate Instructors

Atef Amriche (Syracuse University)
Maria Ashraf (Indiana Purdue University)
Jin Du (University of Wisconsin-Madison)
Victoria Franklin (Cornell University, BWSI 2019 Alum)

Guest Lecturers/Instructors

Sean Anklam (MIT Lincoln Laboratory)
Neale Batra (Applied Epi)
Deborah Campbell (MIT Lincoln Laboratory)
Chad Council (MIT Lincoln Laboratory)
Benjamin Davies (MIT Lincoln Laboratory)
Shamaria Engram (MIT Lincoln Laboratory)
Rose Gould (FEMA MA - Task Force 1)
Chris Grazioso (FEMA MA - Task Force 1)
Ritwik Gupta (Defense Innovation Unit)
Robert Hallowell (MIT Lincoln Laboratory)
Clinton Haverkampf (FEMA MA - Task Force 1)
Mark Hernandez (MIT Lincoln Laboratory)
Scott Kaplan (Civil Air Patrol)
Ricky Kue (FEMA MA - Task Force 1)
Anthony Lapadula (MIT Lincoln Laboratory)
Edward Londner (MIT Lincoln Laboratory)
Brice MacLaren (MIT Lincoln Laboratory)
Tara McEnroe-Kent (FTS-US, Inc.)
Scott McGuire (FEMA MA - Task Force 1)
Renee Oats (US Navy)
Jarlath O'Neil-Dunne (UVM)
Nirav Patel (Defense Innovation Unit)
Megan Richardson (MIT Lincoln Laboratory)
Mark Supernor (FEMA MA - Task Force 1)
Lexie Yang (Oak Ridge National Laboratory)

Build a CubeSat
Sierra Nevada Corp. Project

Lead Instructors

Andrew Dahir (MIT Lincoln Laboratory)
Madeleine Schroeder (MIT Department of Aeronautics and Astronautics)

Instructors

Prof. Kerri Cahoy (MIT Department of Aeronautics and Astronautics)
Paul Fucile (Woods Hole Oceanographic Institution)
Rebecca Keenan (MIT Lincoln Laboratory)
Paul Lawson (MIT Lincoln Laboratory)
Adam Shabshelowitz (MIT Lincoln Laboratory)
Jonathan Parham (MIT Lincoln Laboratory)

Associate Instructors

Aidan Carrier (Northeastern, BWSI 2021 Alum)
Emily McCarthy (Boston University, BWSI 2020 Alum)

Guest Lecturers/Instructors

Dr. Michael Brosnahan (Woods Hole Oceanographic Institution)
Richard Chen (MIT Lincoln Laboratory)
Gary Friedman (NASA Veteran)
Vincent Leslie (MIT Lincoln Laboratory)
Jonathan Parham (MIT Lincoln Laboratory)
Sarah Rogers (MIT Lincoln Laboratory)

Graduate Student Panel

Amelia Bruno (MIT Department of Aeronautics and Astronautics)
Maddie Garcia (MIT Department of Aeronautics and Astronautics)
Christine Page (MIT Department of Aeronautics and Astronautics)
Saba Shaik (MIT Department of Aeronautics and Astronautics)

Unmanned Air System - Synthetic Aperture Radar

Lead Instructor

Ben Marcotte (MIT Lincoln Laboratory)

Instructors

Jerry Benitz (MIT Lincoln Laboratory)
Ramu Bhagavatula (MIT Lincoln Laboratory)
Shreya Pal (Ohio State University)
Frank Schiavone (MIT Lincoln Laboratory)

Associate Instructors

Adithya Sriram Damodaran (Ohio State University)
Jane Mo (Rice University)

Serious Game Design and Development with AI

Lead Instructors

Ronald Kroening (Pace University)
Christopher Walter (RPI Departments of Aeronautical and Mechanical Engineering)

Instructors

Rob Seater (MIT Lincoln Laboratory)

Associate Instructors

Willy Chan (Stanford University, BWSI 2021 Alum)
Cortney Manbeck (Cornell University)
Ulyssess Yarber (Kenyon College)

Embedded Security and Hardware Hacking
MITRE Project

Lead Instructor
Jackie Zeimbekakis (MITRE)

Instructors

Sophia Declene (MITRE)
Madeline Estey (MITRE, BWSI 2020 Alum)
Iv Robinson (MITRE)

Guest Lecturers/Instructors

Rachel Bainbridge (MITRE)
Eric Kedaigle (MITRE)

Special Student

Lin (Kitty) Wang (Stuyvesant High School, BWSI 2021 Alum)

Medlytics: Data Science for Health and Medicine

Lead Instructor

Christian Cardozo-Aviles (MIT)

Instructor

Lama Moukheiber (MIT IDSS)

Associate Instructors

Jillian Chong (Cornell University, BWSI 2021 Alum)
Skyler Shapiro (Cornell University)

Guest Lecturers/Instructors

Dr. Leo Celi (Harvard Medical School)
Dr. Eric Gottlieb (Clinical/Research Fellow in Nephrology, Brigham and Women's Hospital, Harvard University)
Edmarie Guzman-Velez, PhD (Harvard Medical School)
Aryan Jain (Amador Valley High School, BWSI 2021 Alum)
Hector De Jesus-Cortes, PhD (MIT)
Jonathan Ng (CEO, Iterative Scopes; MIT 2020 Sloan School of Management Alum)
Alay Shah (MIT Department of Electrical Engineering and Computer Science)

Special Students

Aryan Jain (Amador Valley High School, BWSI 2021 Alum)

Observer

Sulaiman Moukhaiber (Worcester Polytechnic Institute)

Design of Assistive Technology (AT)

Lead Instructor

Dr. Hosea Siu (MIT Lincoln Laboratory)

Associate Instructors

Dr. Evan Buchheit (Chatham University)
Lauren Candia (Jefferson University, East Falls)
Meghana Gopannagari (University of Illinois Urbana-Champaign, BWSI 2021 Alum)
Thomas Hewitt (Massachusetts College of Art and Design)
Daniel Wang (Johns Hopkins University, BWSI 2021 Alum)

Guest Lecturers/Instructors

Laura D'Aquila (Google)
Alix Dorfman (UL Solutions)
Chrissy Glover (Imago Rehab)
Bryce Johnson (Microsoft)
Samantha Johnson (Tatum Robotics)
Abigail Klein (Google)
Adriana Mallozzi (Puffin Innovations)
Jonathan Zong (MIT)

Special Students

Miriam Brody (Pomona College, BWSI 2021 Alum)
Grace Zhen (University of Illinois Urbana-Champaign, BWSI 2021 Alum)

Observer

Sejal Mittal (Savannah College of Art and Design)

Cyber Operations

Lead Instructor

Adam Wong (MIT Lincoln Laboratory)

Instructors

Noah Luther (MIT Lincoln Laboratory)
Michael Straub (MIT Lincoln Laboratory)

Associate Instructors

Shannon Assouline (Northeastern University)
Mason Coco (Colorado State University)
Emma Mascillaro (Olin College of Engineering, BWSI 2019, 2020 Alum)

Guest Lecturers/Instructors

Roger G. Andras (OpenText/EnCase)
Victor DeLaPena (OpenText/EnCase)
Randy Duprey (NuHarbor Security)
Ari Eitan (Intezer)
Micah Hoffman (Spotlight-InfoSec, LLC)
Meredith Kasper (Hurricane Labs)
Eric Kobelski (NuHarbor Security)
Tom Kopchak (Hurricane Labs)
Petre Manev (Open Information Security Foundation / StamusNetworks)
Justin Pascale (Dragos, Inc)
David Porco (SME, Twitter: @OMENScan)
Craig Porter (OpenText/EnCase)
Fatema B. Walla (Zeek, Ltd.)
John Wetzel (RecordedFuture)

Autonomous Underwater Vehicle Challenge
ONR Autonomous Maritime Vehicles Engineering Project

Lead Instructor

Dr. Madeline Miller (MIT Lincoln Laboratory)

Instructor

Dr. Joe Edwards (MIT Lincoln Laboratory)

Associate Instructors

Ashley Kamal (MIT Lincoln Laboratory)
Daniel Pearson (Worcester Polytechnic Institute)
Michael Rivera (College of Staten Island)

Guest Lecturers/Instructors

Dr. Nicholas Beaird (MIT Lincoln Laboratory)
Prof. John Leonard (MIT Department of Mechanical Engineering)
George Probst (SharkPix.com)
Dr. Alexandra Van Dine (MIT Lincoln Laboratory)

Linux/Python Support

Dr. Evan Leventhal (Harvard Medical School)

Quantum Software
MITRE Project

Lead Instructor

Richard Preston (MITRE)

Instructor

Joe Clapis (MITRE)
Melvin Lin (MITRE)

Associate Instructors

Nikita Borisov (University of Pennsylvania)
Jon Christie (MITRE, University of Connecticut)
Diptanshu Sikdar (University of California Irvine, BWSI 2021 Alum)
Dylan VanAllen (Syracuse University)

Guest Lecturers/Instructors

Filip Aronshtein (Johns Hopkins University / Durac)
Prof. Paola Cappellaro (MIT Department of Nuclear Science and Engineering)
Dr. Gen Clark (MITRE)
Rebecca Krauthamer (QuSecure)
Peter McMahon (Cornell University)
Mariia Mykhailova (Microsoft Quantum Development)
Dr. Kevin Obenland (MIT Lincoln Laboratory)
Dr. Brandon Rodenburg (MITRE)
Dr. Christian Weedbrook (Xanadu)

Autonomous RACECAR Grand Prix
BWSI - Kwajalein

Lead Instructor

Sarah Willis (MIT Lincoln Laboratory)

Instructors

Stephanie Fried (MIT Lincoln Laboratory)
Ranny Ranis (MIT Lincoln Laboratory)
Jon Schoenenberger (MIT Lincoln Laboratory)

Associate Instructors

John MacTavish (National War College Alum)
Crimson Stambaugh (Southern New Hampshire University, BWSI 2020, 2021 Alum)

BWSI 2022 Women's Networking Dinner and Panel Discussion

Tuesday, July 26, 2022

Prof. Kerri Cahoy (MIT Department of Aeronautics and Astronautics)
Charmain Jackman (InnoPysch)
Genevieve Hamer (BAE)
Elizabeth Marios (SWE Boston)
Elizabeth McGovern (Patrick J. McGovern Foundation)
Emily Peterson (MIT Lincoln Laboratory)
Jenn Watson (MIT Lincoln Laboratory)
Kelly Zaleski (Raytheon)

BWSI 2022 Diversity, Equity and Inclusion Workshops

BWSI 2022 Diversity, Equity and Inclusion Workshop on July 21, 2022

Gabriel Campos (MIT Human Resources, Director, Diversity, Equity & Inclusion)
Enanga Fale (NSBE ASIG)
Michelle Lin (MIT Department of Aeronautics and Astronautics)
Rachel Morgan (MIT Department of Aeronautics and Astronautics)
Cadence Brea Payne (MIT Department of Aeronautics and Astronautics)
Kanokwan Tungkithancharoen (MIT Department of Mechanical Engineering and MIT Department of Political Science)

BWSI 2022 Diversity, Equity and Inclusion Workshop on August 3, 2022

Consuelo Cuevas (MIT Lincoln Laboratory)
Roberto Martinez (MIT Lincoln Laboratory, Director, Diversity, Equity & Inclusion)
Adrienne Sands (MIT Lincoln Laboratory)
Charlotte Shabarekh (MIT Lincoln Laboratory)
Eyassu Shimelis (Boston Dynamics)
Emily Voytek (MIT Lincoln Laboratory)
Shireen Warnock (MIT Lincoln Laboratory)

MIT Beaver Works Summer Institute

2022 Summer Program

Class of 2022

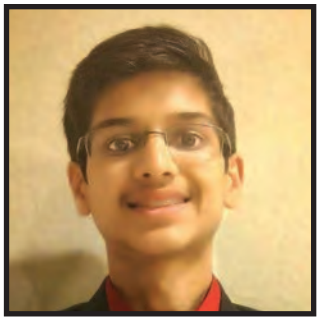
Ayush Agarwal
Nikita Agarwal
Shrey Agarwal
Matthew Alex
Mayha Ali
Akshya Amarnath
Reva Amritkar
Alex Anderson
Maria Andreu
Darius Arasteh
Harshil Avlani
David Bai
Maxim Balabanski
Andria Bao
Camden Bartlo
Jaden Bayrooti
Ethan Behne
Elena Behzadi
Benjamin Belotser
Charles Benjamin
Zeel Bhayani
Samarth Bikki
Sejal Bilwar
Caasi Boakye
Alexander Bokelman
Dia Brar
Ty Brennan
Miriam Brody
Samuel Buena
Abhinav Bulusu
Caroline Cadena
Wendy Cao
Russell Castro
Sreeja Challa
Jillian Chang
Thomas Chang
Alina Chen
Allison Chen
Brian Chen
Eric Chen
Jessie Chen
Kang Chen
Kian Chen
Michelle Chen
Ronghe Chen
Roy Chen
Russell Chen
Yuri Chentsov
Aiden Cheong
Vihaan Chinthakindi
Daniel Cho
David Cho
Justin Choi
Irene Chon
Yuna Chun
Noah Cooney
Joshua Corona
Rayan Das
Anna David
Rishita Dhalbisoi
Amruta Dharmapurikar
Alison Ding
Nicole Ding
Benjamin Dodge
Tiancheng Dong
Jude Downing
Manya Dua
Samhitha Duggirala
Mihika Dusad
Hudson Kaleb Dy
Aniketh Eswara
Boueny Folefack
Eric Ford
Helena Fountas
Eleanor Fredine
Jessica Fu
Kirby Fung
Linnea Furlan
Ashrita Gandhari
Chloe Gao
Leison Gao
Timothy Gao
Tanush Garg
Pari Gill
Sarah Godfrey
Gaurav Goel
Arsh Goenka
Eric Gorski
Fedor Goryanyy
Prerana Gowda
Avani Goyal
Cassiel Graullera
Daniel Guo
Xinyu Guo
Amishi Gupta
Anshul Gupta
Neiv Gupta
Tammer Haddad
Lea Muminovic Hadzic
Dexter Haehnichen
Christopher Eliot Hall
Junhyeok Han
Zhuoxi Han
Paul Hanson
Jonathan He
Ireh Hong
Hongyi Hu
Katherine Hua
Samantha Hua
Grace Huang
Huanhuan Huang
Grace Hur
Hyun Bum Hur
Yuta Ioriya
Ritvik Irigireddy
Dylan Isaac
Aryan Jain
Aadarsh Jasthi
Aadarsh Jasthi
Shinyoung Jeon
Elaine Jiang
Neven Johnson
Patrick Johnson
Akshay Joshi
Caden Juang
Samuel Jung
Eshaan Kaipa
Shreya Kanaujia
Aesha Kapoor
Devesh Karthik
Japleen Kaur
Anya Khosla
Aron Kim
Chowon Kim
Daniel Kim
Jiwoo Kim
Stanley Kim
Jayden Koh
Derek Kong
Alexander Korolev
Andrey Korolev
Dwight Koyner
Diya Krishnan
Joshua Krishnappa
Malcolm Krolick
Ella Kronman
Aditi Kumar
Pratham Kumar
Evan Kuo
Johan Lakshmanan
Huy Le
Tal Ledeniov
Hannah Lee
Hansel Lee
Jaiden Lee
Kaleb Lee
Nicole Lee
Sunghoon Lee
Nathan Lemma
Brayden Levangie
Angel Li
Claire Li
Evelyn Li
Michael Li
Portia Li
Richard Li
Yuanzhe Li
Ivy Lian
Lake Liao
Audi Lin
Leo Lin
Peter Lin
Stephanie Lin
Yuru Lin
Thomas Lisa
Amy Liu
Jazlynn Liu
Maggie Liu
Amber Lo
Katherine Lu
Katherine Lu
Harshini Magesh
Varsha Makkapati
Nicolas Makovnik
Jordi Malaret
Songhang Man
Ananya Manduva
Owen Matheson
Satvik Matta
Fiona McSherry
Sahil Mehta
Rumeysa Mert
Carter Mitchell
Benjamin Modiano
Amal Mohamed
Sumaya Mohamed
Ayushi Mohanty
Jennifer Mori
Andrew Moses
Ranvitha Muramreddy

MIT Beaver Works Summer Institute

2022 Summer Program

Class of 2022

Shivatmica Murgai
Mihir Nagarkatti
Vishnu Nair
Yujiro Nakano
Shruti Narwaney
Nathan Neidigh
Christiana Nguyen
Brian Ni
Johnny Ni
Neil Noronha
Lillian Nove
Avaneesh Pal
Aprameya Pandit
Nishad Pandya
Bhargav Panguluru
Dhatri Parakal
Vraj Parikh
Hyojae Park
Krishnaveni Parvataneni
Amrita Pasupathy
Rishi Peddakama
Venkata Anjani
Shravika Pendyala
Jiankun Peng
Steven Pereanu
Harsha Pillarisetti
Isabelle Pinto
Supawat Pitaknarongphorn
Isha Prem
Sebastian Pujet
Sanjana Pulaparthi
Andrew Qin
Jason Qin
Zhixiang Qiu
Viplove Rahate
Rhea Rai
Karan Ramachandran
Chinmayi Ranade
Amratha Rao
Unsh Rawal
Nihitha Reddy
Logan Reich
Zayn Rekhi
Shaunak Rembhotkar
Jack Rimel
Grant Sackmann
Neil Sash
Aneeka Sawarkar
Roman Sejnoha
Navya Seth
Piyush Sethy
Ava Shah
Niyati Shah
Romil Shah
Jayashabari Shankar
Shivnath Shankar
Tanay Sharma
Tanaya Sharma
Ilia Sharonov
Karen Shekyan
Gracie Sheng
Elisabeth Shin
Madeline Shin
Swas Shiv
Neta Shubin
Nikil Shyamsunder
George Simmons
Grant Sims
Shreya Singh
Shalin Sinha
Rohan Siva
Foster Smith
Kai Song
Selina Song
Sol Song
Laya Srinivas
Niyathi Srinivasan
Raghav Srinivasan
Pranav Subbarayan
Ananya Subramanyam
Keshav Subramonian
Michelle Sun
Nandana Surendran
Jia Syuan Chang
Chirapon Taepaisitphongse
Pran Taepaisitphongse Ranchida Taepaisitphongse
Jamie Tan
Jiafeng Tang
Mihir Tatavarti
Kshitij Teotia
Nevin Thinagar
Edward Thomas
Joshua Thomas
My Thu Trinh
Christine Tian
Kanishk Tihaiya
Akshata Tiwari
James To
Alexander Tong
Johnathan Tong
Alex Tornese
Adrian Tran
Alexander Tsai
Aishwaryaa Udeshi
Veronica Vacaras
Vibusha Vadivel
Sarvagna Velidandla
Akshay Vemulapalli
Medha Venkatapathy
Maanasa Viswanath
Eric Vo
Alan Wang
David Wang
Derek Wang
Jake Wang
Jessie Wang
Jonathan Wang
Katherine Wang
Lin Wang
Rena Wang
Tina Wang
Holly Weber
Audrey Wei
Lily Wei
Tyler Westland
Shane Williams
Steven Wu
Yuanfeng Wu
Ziqian (Alice) Xiao
Elaina Xiao
Felix Xie
Bernard Xu
Stephen Xu
Wenbo Xu
Aaron Yang
Catherine Yang
Christian Yang
David Yang
Eleanor Yang
Jenna Yang
Jessica Yang
Nicholas Yap
Gavin Ye
Warren Yun
Alex Yung
Derek Zang
Eloise Zeng
Luca Zerega
Ada Zhang
Alex Zhang
Angelina Zhang
Ashley Zhang
Sophia Zhang
Tiankuo Zhang
Tiankuo Zhang
Wanying Zhang
Sophia Zhao
Emma Zheng
Patrick Zheng
Benjamin Zhou
Hannah Zhou
Tony Zhou
Hannah Zook
Mohammad Zoraiz
Zonghao Zou



Ayush Agarwal
Remote Sensing for Disaster Response
BASIS Independent Silicon Valley, CA
(San Jose, CA)

Nikita Agarwal
Serious Game Development for AI
Memorial High School
(Frisco, TX)

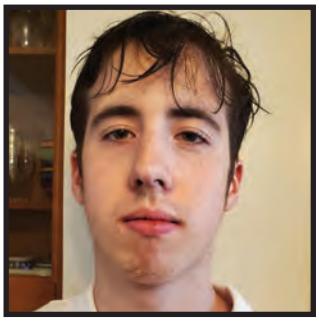
Shrey Agarwal
Autonomous RACECAR Grand Prix
Bridgewater-Raritan High School, NJ
(Bridgewater, NJ)

Matthew Alex
Serious Game Development for AI
Nashua High School South, NH
(Nashua, NH)

Mayha Ali
Serious Game Development for AI
Westford Academy, MA
(Westford, MA)

Akshya Amarnath
Underwater Autonomous Vehicle Challenge (AUV)
Lenape High School
(Medford, NJ)

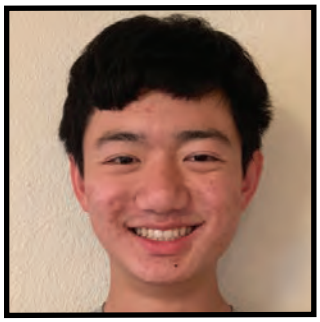
Reva Amritkar
Autonomous Air Vehicle Racing (UAV)
Middlesex County Academy, Edison NJ
(Edison, NJ)



Alex Anderson
Serious Game Development for AI
Arlington Career Center
(Arlington, VA)

Maria Andreu
Cyber Security in Software Intensive Systems
Colegio Puertorriqueño de Niñas Urb. Golden Gate 208 Cll Turquesa Guaynabo, Puerto Rico 00969 (Puerto Rico)

Darius Arasteh
Underwater Autonomous Vehicle Challenge (AUV)
Campolindo High School
(Moraga, CA)



David Bai
Underwater Autonomous Vehicle Challenge (AUV)
Valley Christian High School, CA
(San Jose, CA)

Maxim Balabanski
Underwater Autonomous Vehicle Challenge (AUV)
Academies of Loudoun - Academy of Engineering and Technology, VA (Leesburg, VA)

Andria Bao
Quantum Software
St. Mark's School
(Southborough MA)

Camden Bartlo
Autonomous Air Vehicle Racing (UAV)
Nichols School
(Buffalo, NY)

Jaden Bayrooti
Autonomous Air Vehicle Racing (UAV)
Hackley School
(Tarrytown, NY)

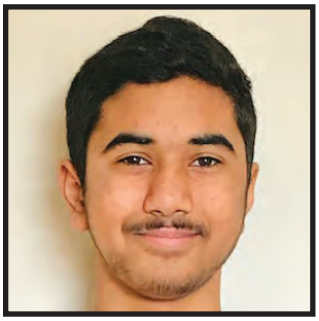
Ethan Behne
Cyber Security in Software Intensive Systems
Homeschool
(Fulshear, TX)

Elena Behzadi
Autonomous Racecar Grand Prix
Los Angeles Center for Enriched Studies
(Los Angeles, CA)

Benjamin Belotser
Embedded Security and Hardware Hacking
Stuyvesant High School, NY
(New York, NY)

Charles Benjamin
Autonomous Air Vehicle Racing (UAV)
Phillips Academy Andover, MA
(Andover, MA)

Zeel Bhayani
Cyber Security in Software
Intensive Systems
Whitney High School, CA
Cerritos, CA



Samarth Bikki
Cyber Security in Software
Intensive Systems
Westwood High School, TX
(Austin, TX)

Sejal Bilwar
Designing for Assistive Technologies
American High School, CA
(Fremont, CA)

Caasi Boakye
Autonomous Cognitive Assistant
Osbourn Park High School
(Manassas, VA)

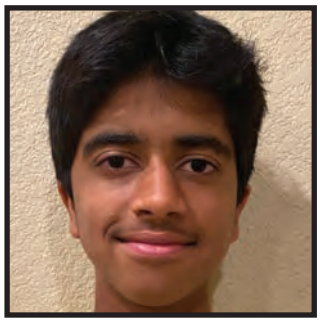
Alexander Bokelman
Cyber Security in Software
Intensive Systems
Urbana High School, MD
(Ijamsville, MD)

Dia Brar
Serious Game Development for AI
Brooklyn Technical High School, NY
(Brooklyn, NY)

Ty Brennan
UAS-SAR
Geffen Academy at UCLA
(Los Angeles, CA)

Miriam Brody
Designing for Assistive Technologies

Samuel Buena
UAS-SAR
Bronx High School of Science, NY
(Bronx, NY)



Abhinav Bulusu
Designing for Assistive Technologies
Westlake High School, TX
(Westlake, TX)

Caroline Cadena
Quantum Software
Governor's School for Science &
Mathematics, SC
(Hartsville, SC)

Wendy Cao
Remote Sensing for Disaster Response
University High School, CA
(Irvine, CA)

Russell Castro
Autonomous Air Vehicle Racing (UAV)
California Academy of Mathematics
and Science, CA
(Carson, CA)

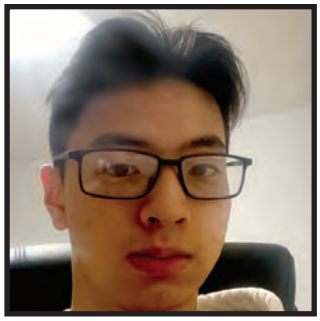
Sreeja Challa
Medlytics
Denmark High School, GA
(Alpharetta, GA)

Jia Syuan Chang
Cyber Security in Software Intensive Systems
Cupertino High School, CA
(Cupertino, CA)

Thomas Chang
Build A Cubesat
Lick-Wilmerding High School
(San Francisco, CA)

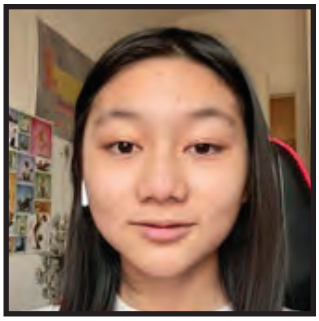
Alina Chen
Remote Sensing for Disaster Response
Thomas Jefferson High School, VA
(Alexandria, VA)

Allison Chen
Serious Game Development for AI
Hopkinton High School, MA
(Hopkinton, MA)



Brian Chen
Autonomous Cognitive Assistant
North Quincy High School, MA
(North Quincy, MA)

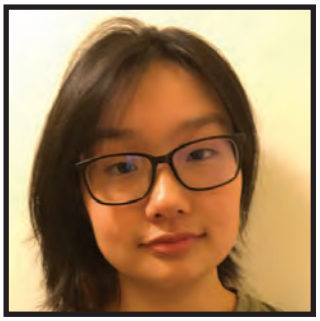
Eric Chen
Autonomous Cognitive Assistant
Garnet Valley High School
(Glen Mills, PA)



Jessie Chen
Embedded Security and Hardware Hacking
University High School, CA
(Irvine, CA)

Kang Chen
Autonomous Racecar Grand Prix
The Waldorf School of Garden City
(Garden City, NY)

Kian Chen
RUAS-SAR
Harvard-Westlake School, CA
(Studio City, CA)



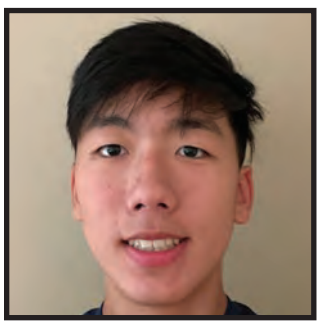
Michelle Chen
Embedded Security and Hardware Hacking
Bronx High School of Science, NY
(Bronx, NY)

Ronghe Chen
Remote Sensing for Disaster Response
Walter Payton College Prep, IL
(Chicago, IL)

Roy Chen
Cyber Security in Software Intensive Systems
Bronx High School of Science, NY
(New York City, NY)

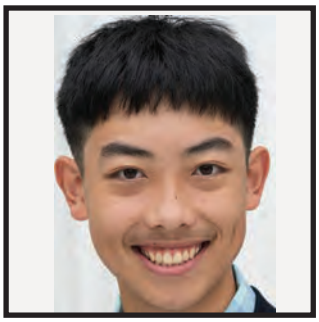
Russell Chen
Remote Sensing for Disaster Response
Lynbrook High School, CA
(San Jose, CA)

Yuri Chentsov
Medlytics
The Brooklyn Latin School
(Brooklyn, NY)



Aiden Cheong
Autonomous Racecar Grand Prix
Thomas Jefferson High School, VA
(Alexandria, VA)

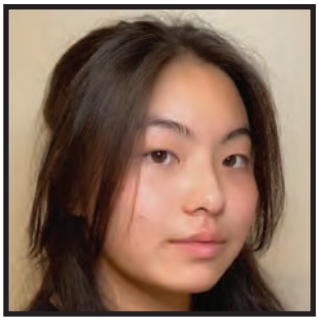
Vihaan Chinthakindi
Remote Sensing for Disaster Response
Homestead High School, CA
(Cupertino, CA)



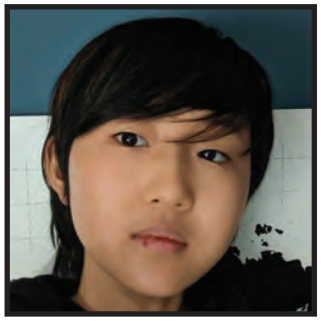
Daniel Cho
Quantum Software
Belmont Hill School
(Belmont, MA)

David Cho
Medlytics
Belmont Hill School
(Belmont, MA)

Justin Choi
UAS-SAR
Oakton High School
(Vienna, VA)



Irene Chon
Remote Sensing for Disaster Response
Monta Vista High School, Cupertino CA
(Cupertino, CA)



Yuna Chun
Quantum Software
Montgomery Blair High School, MD
(Silver Spring, MD)

Noah Cooney
Quantum Software
The Westminster Schools
(Atlanta, GA)

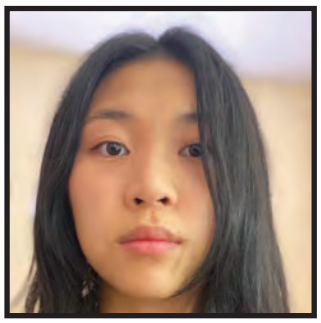
Joshua Corona
Designing for Assistive Technologies
Eno River Academy
(Hillsborough, NC)

Rayan Das
Remote Sensing for Disaster Response
Archbishop Mitty High School
(San Jose, CA)

Anna David
Autonomous Air Vehicle Racing (UAV)
Franklin High School, MA
(Franklin, MA)

Rishita Dhalbisoi
UAS-SAR
American High School, CA
(Fremont, CA)

Amruta Dharmapurikar
Underwater Autonomous Vehicle
Challenge (AUV)
Harker School, CA
(San Jose, CA)



Alison Ding
Serious Game Development for AI
BASIS Independent Silicon Valley, CA
(San Jose, CA)

Nicole Ding
Cyber Security in Software
Intensive Systems
Stephen F. Austin High School
(Sugar Land, TX)

Benjamin Dodge
Quantum Software
Leonardtown High School
(Leonardtown, MD)

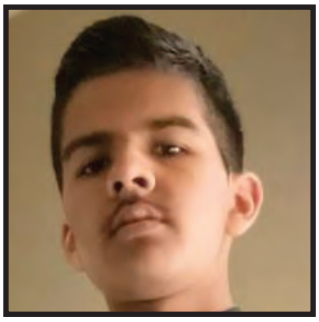
Tiancheng Dong
Designing for Assistive Technologies
Northwood High School, CA
(Irvine, CA)

Jude Downing
Serious Game Development for AI
Houston High School
(Memphis,TN)

Manya Dua
Autonomous Cognitive Assistant
Eastlake High School, WA
(Sammamish, WA)

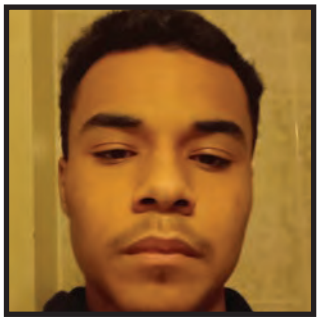
Samhitha Duggirala
Cyber Security in Software Intensive Systems
Del Norte High School, CA
(San Diego, CA)

Mihika Dusad
Autonomous Air Vehicle Racing (UAV)
Thomas Jefferson High School, VA
(Alexandria, VA)



Aniketh Eswara
Designing for Assistive Technologies
Dougherty Valley High School
(San Ramon, CA)

Boueny Folefack
Autonomous Cognitive Assistant
Carroll Senior High School
(Southlake, TX)

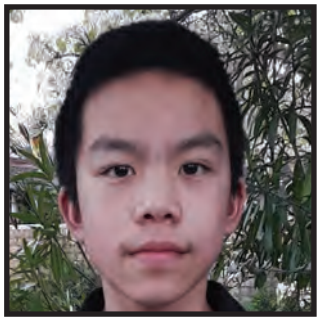


Eric Ford
Quantum Software
Central High School
(Philadelphia, PA)

Helena Fountas
Autonomous RACECAR Grand Prix
Boston Latin, MA
(Boston, MA)

Eleanor Fredine
UAS-SAR
Andover High School
(Andover, MN)

Jessica Fu
UAS-SAR
The Kinkaid School
(Houston, TX)

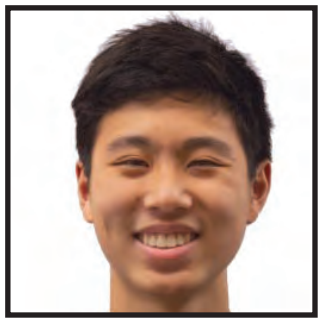


Kirby Fung
Designing for Assistive Technologies
Saratoga High School, CA
(Saratoga, CA)

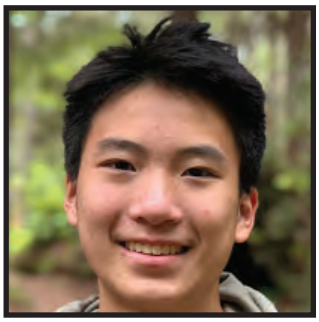
Linnea Furlan
Underwater Autonomous Vehicle Challenge (AUV)
Design Tech High School
(Belmont, CA)

Ashrita Gandhari
Medlytics
Thomas Jefferson High School, VA
(Alexandria, VA)

Chloe Gao
Embedded Security and Hardware Hacking
McLean High School
(McLean, VA)



Leison Gao
Underwater Autonomous Vehicle Challenge (AUV)
Los Gatos High School, CA
(Los Gatos, CA)

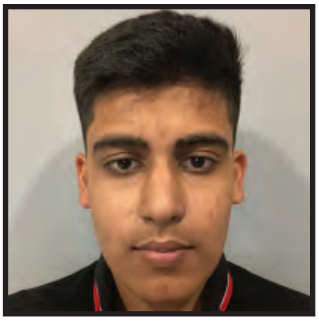


Timothy Gao
Quantum Software
Amador Valley High School
(Pleasanton, CA)

Tanush Garg
UAS-SAR
Ashland High School, MA
(Ashland, MA)

Pari Gill
Cyber Security in Software Intensive Systems
Pari Gill
(Scotch Plains, NJ)

Sarah Godfrey
Designing Assistive Technologies
Lexington Christian academy
(Lexington, MA)



Arsh Goenka
Medlytics
Nashua High School South, NH
(Nashua, NH)

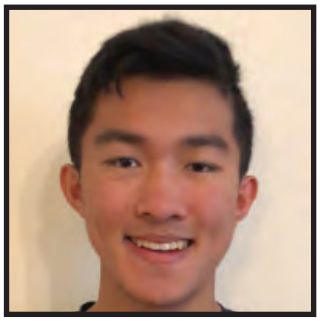
Eric Gorski
Build A Cubesat
Governor's School for Science & Mathematics, SC
(Hartsville, SC)

Fedor Goryanyy
Designing for Assistive Technologies
Neeham High School, MA
(Needham, MA)

Prerana Gowda
Autonomous Cognitive Assistant
Dougherty Valley High School, CA
(San Ramon, CA)

Avani Goyal
Serious Game Development for AI
Dougherty Valley High School, CA
(San Ramon, CA)

Cassiel Graullera
Quantum Software
Trinity School, NY
(New York, NY)



Daniel Guo
Cyber Security in Software Intensive Systems
North Oconee High School
(Bogart, GA)

Xinyu Guo
Underwater Autonomous Vehicle Challenge (AUV)
Leland High School, CA
(San Jose, CA)

Amishi Gupta
Medlytics
North Carolina School of Science and Mathematics, NC
(Durham, NC)

Anshul Gupta
Designing for Assistive Technologies
Archbishop Mitty High School
(San Jose, CA)

Neiv Gupta
Remote Sensing for Disaster Response
Monta Vista High School, Cupertino CA
(Cupertino, CA)

Tammer Haddad
Serious Game Development for AI
Lexington High School MA
(Lexington, MA)

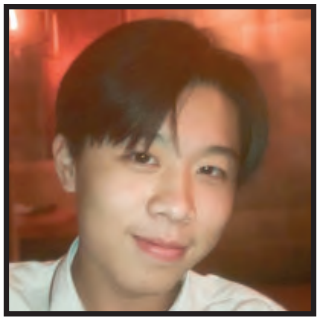
Dexter Haehnichen
Embedded Security and Hardware Hacking
The Charter School Of San Diego
(San Diego, CA)

Christopher Eliot Hall
Serious Game Development for AI
Independence High School, CA
(San Jose, CA)

Junhyeok Han
Medlytics
Academy of the Canyons
(Santa Clarita, CA)

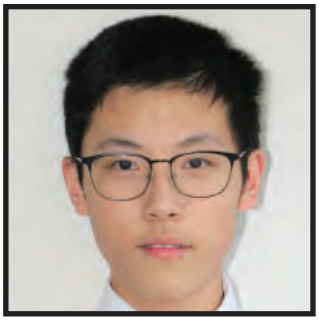
Zhuoxi Han
Autonomous Racecar Grand Prix
Bellevue High School
(Bellevue, WA)

Paul Hanson
Autonomous Air Vehicle Racing (UAV)
Great Hearts Northern Oaks
(San Antonio, TX)



Jonathan He
Autonomous Air Vehicle Racing (UAV)
Texas Academy of Math & Science, TX
(Allen, TX)

Ireh Hong
Medlytics
Lexington High School MA
(Lexington, MA)

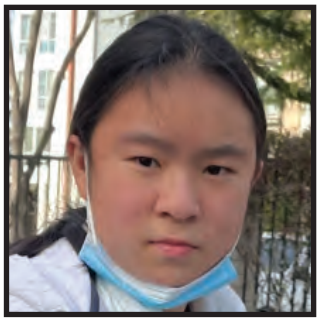


Hongyi Hu
Embedded Security and
Hardware Hacking
The Overlake School, WA
(Redmond, WA)

Katherine Hua
Designing for Assistive Technologies
Woodbridge High School
(Irvine, CA)

Samantha Hua
UAS-SAR
Stuyvesant High School, NY
(New York, NY)

Grace Huang
Cyber Security in Software
Intensive Systems
Lowell High School
(San Francisco, CA)



Huanhuan Huang
UAS-SAR
BASIS Independent Silicon Valley, CA
(San Jose, CA)

Grace Hur
Designing for Assistive Technologies
James Clemens High School
(Madison, AL)

Hyun Bum Hur
Serious Game Development for AI
Stuyvesant High School, NY
(New York, NY)

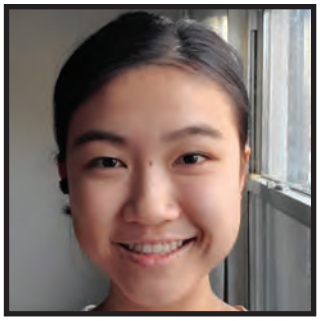
Yuta Ioriya
Autonomous Air Vehicle Racing (UAV)
Ruben S. Ayala High School
(Chino Hills, CA)

Ritvik Irigireddy
Medlytics
Canyon Crest Academy, San Diego CA
(San Diego, CA)

Dylan Isaac
Serious Game Development for AI
Edgewater High School
(Orlando, FL)

Aadarsh Jasthi
Cyber Security in Software
Intensive Systems
BASIS Scottsdale
(Scottsdale, AZ)

Shinyoung Jeon
Medlytics
Thomas Jefferson High School, VA
(Alexandria, VA)

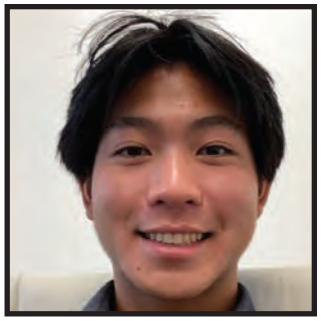


Elaine Jiang
Autonomous Cognitive Assistant
Bronx High School of Science, NY
(Elmhurst, NY)

Neven Johnson
Embedded Security and
Hardware Hacking
Concord Carlisle High School, MA
(Concord, MA)

Patrick Johnson
Embedded Security and
Hardware Hacking
Moravian Academy, Bethlehem PA
(Easton, PA)

Akshay Joshi
Designing for Assistive Technologies
Palo Alto High School, CA
(Palo Alto, CA)



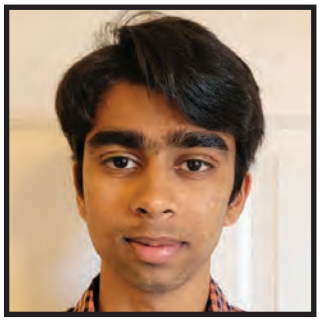
Caden Juang
Autonomous Cognitive Assistant
Saint John's, Houston, TX
(Houston, TX)

Samuel Jung
Serious Game Development with AI
Bergen County Academies,
Hackensack NJ (Hackensack, NJ)

Eshaan Kaipa
Autonomous Air Vehicle Racing (UAV)
Evergreen Valley High School, San Jose CA
(San Jose, CA)

Shreya Kanaujia
Cyber Security in Software
Intensive Systems
Lexington High School MA
(Lexington, MA)

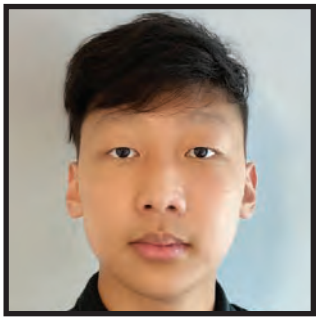
Aesha Kapoor
Serious Game Development for AI
Academies of Loudoun - Academy
of Engineering and Technology, VA
(Leesburg, VA)



Devesh Karthik
Quantum Software
Rocky Hill High School
(Rocky Hill, CT)

Japleen Kaur
Autonomous Cognitive Assistant
Evergreen Valley High School,
San Jose CA
(San Jose, CA)

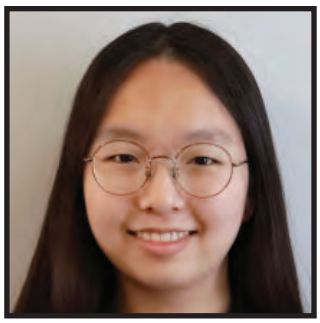
Anya Khosla
Autonomous Air Vehicle Racing (UAV)
Cupertino High School, CA
(Cupertino, CA)



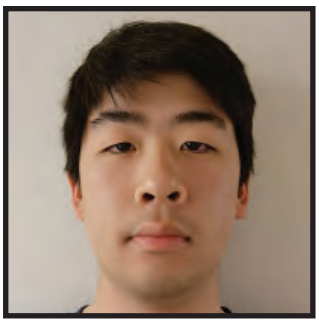
Aron Kim
Medlytics
Bronx High School of Science, NY
(Flushing, NY)

Chowon Kim
Serious Game Development with AI
La Canada High School
(La Canada, CA)

Daniel Kim
Medlytics
Horace Greeley High School
(Chappaqua, NY)



Jiwoo Kim
Autonomous Racecar Grand Prix
Homestead High School, CA
(Cupertino, CA)



Stanley Kim
Embedded Security and
Hardware Hacking
Woodberry Forest School, VA
(Woodberry Forest, VA)

Jayden Koh
Embedded Security and
Hardware Hacking
Michael E. DeBakey High School
(Houston, TX)

Derek Kong
Remote Sensing for Disaster Response
Arnold O. Beckman High School
(Irvine, CA)

Alexander Korolev
Cyber Security in Software
Intensive Systems
Brooklyn Technical High School, NY
(Brooklyn, NY)

Andrey Korolev
Autonomous Air Vehicle Racing (UAV)
Brooklyn Technical High School, NY
(Brooklyn, NY)

Dwight Koyner
Designing for Assistive Technologies
Weston High School
(Weston, CT)

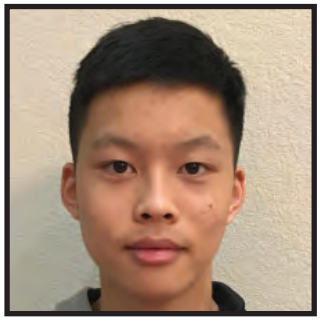
Joshua Krishnappa
Autonomous Cognitive Assistant
Rock Ridge High School
(Ashburn, VA)

Malcolm Krolick
Cyber Security in Software
Intensive Systems
Hackley School
(Tarrytown, NY)

Ella Kronman
Cyber Security in Software
Intensive Systems
Hunter College High School, NY
(New York, NY)

Aditi Kumar
Autonomous Air Vehicle Racing (UAV)
Illinois Math & Science Academy, IL
(Aurora, IL)

Pratham Kumar
Medlytics
Wayne Hills Highschool
(Wayne, NJ)

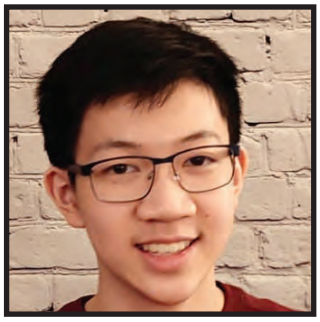


Evan Kuo
Autonomous Cognitive Assistant
St. Dominic Savio Catholic High School
(Austin, TX)

Huy Le
Build A Cubesat
Mater Dei Prep
(Middletown, NJ)

Tal Ledeniov
Medlytics
Bergen County Academies,
Hackensack NJ (Hackensack, NJ)

Hannah Lee
Build A Cubesat
Bronx High School of Science, NY
(Bronx, NY)



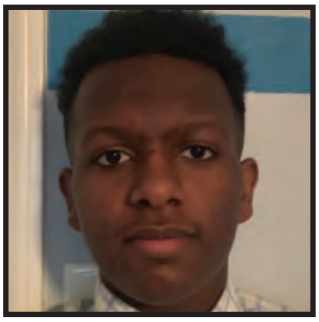
Hansel Lee
Embedded Security and
Hardware Hacking
North Creek High School
(Bothell, WA)

Jaiden Lee
Serious Game Development for AI
Millburn High School
(Millburn, NJ)

Kaleb Lee
Underwater Autonomous
Vehicle Challenge (AUV)
Troy High School, CA
(Fullerton, CA)

Nicole Lee
Embedded Security and
Hardware Hacking
Academy for Science & Design, NH
(Nashua, NH)

Sunghoon Lee
Cyber Security in Software
Intensive Systems
Valor International Scholars
(Beaverton, OR)

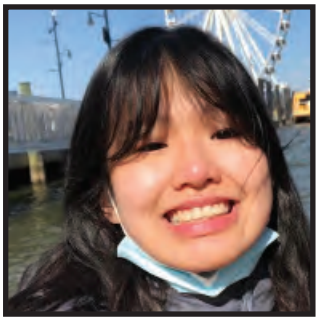


Nathan Lemma
Quantum Software
Lawrence E. Elkins HS
(Houston TX)

Brayden Levangie
Autonomous Cognitive Assistant
West Boylston High School, MA
(West Boylston, MA)

Angel Li
Medlytics
Coral Gables Senior High
(Coral Gables, FL)

Claire Li
Cyber Security in Software
Intensive Systems
Mounds View High School, MN
(Shoreview, MN)



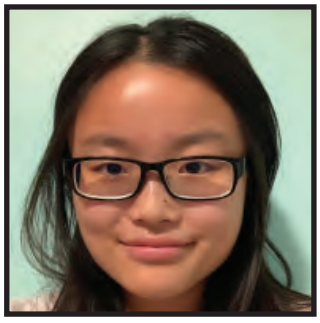
Evelyn Li
Build A Cubesat
Thomas Jefferson High School, VA
(Alexandria, VA)

Michael Li
Embedded Security and
Hardware Hacking
Thomas Jefferson High School, VA
(Alexandria, VA)

Portia Li
Cyber Security in Software
Intensive Systems
Acton Boxborough Regional High School
(Acton-Boxborough, MA)

Richard Li
UAS-SAR
Weston High School, MA
(Weston, MA)

Yuanzhe Li
Designing for Assistive Technologies
Bergen Catholic High School
(Oradell, NJ)

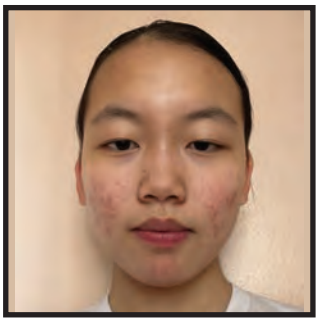


Ivy Lian
Build A Cubesat
Sanford H. Calhoun High School
(Merrick, NY)

Audi Lin
Serious Game Development for AI
Lexington High School MA
(Lexington, MA)

Leo Lin
Underwater Autonomous Vehicle Challenge (AUV)
Monta Vista High School, Cupertino CA
(Cupertino, CA)

Peter Lin
Autonomous Racecar Grand Prix
South Fork High School
(Stuart, FL)



Stephanie Lin
Remote Sensing for Disaster Response
Stuyvesant High School, NY
(New York, NY)

Yuru Lin
Autonomous Air Vehicle Racing (UAV)
The Baldwin School, PA
(Bryn Mawr, PA)

Thomas Lisa
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Northwest Career and Technical Academy
(Las Vegas, NV)

Amy Liu
Autonomous Cognitive Assistant
Benjamin Franklin High School
(New Orleans, LA)

Jazlynn Liu
Autonomous Racecar Grand Prix
Paul D. Schreiber High School
(Port Washington, NY)

Maggie Liu
Autonomous Air Vehicle Racing (UAV)
Leland High School, CA
(San Jose, CA)

Amber Lo
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Syossett High School, NY
(Syosset, NY)

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Underwater Autonomous Vehicle Challenge (AUV)
Lincoln-Sudbury Regional High School, MA ((Sudbury, MA)

Harshini Magesh
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Acton-Boxborough Regional High School
(Acton, MA)

Varsha Makkapati
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Ellicott City MD (Ellicott City, MD)

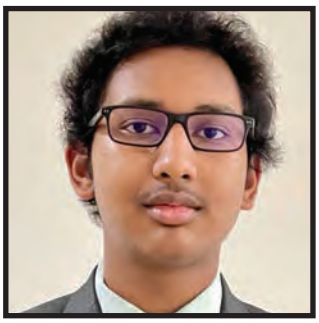
Nicolas Makovnik
UAS-SAR
Thomas Jefferson High School, VA
(Alexandria, VA)

Jordi Malaret
Autonomous Cognitive Assistant
Minnetonka High School
(Minnetonka, MN)

Songhang Man
Serious Game Development for AI
The Harley School
(Rochester, NY)

Ananya Manduva
Designing for Assistive Technologies
Milpitas High School, CA
(Milpitas, CA)

Owen Matheson
Quantum Software
The Wheeler School, RI
(Providence, RI)

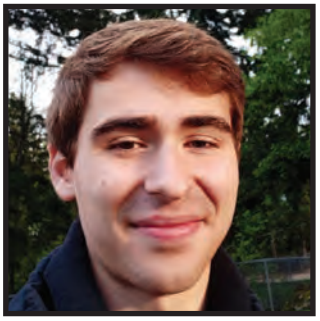


Satvik Matta
Serious Game Development for AI
Thomas Jefferson High School, VA
(Alexandria, VA)

Fiona McSherry
Build A Cubesat
Canyon Crest Academy, San Diego CA
(San Diego,CA)

Sahil Mehta
Remote Sensing for
Disaster Response
Amador Valley High School
(Pleasanton, CA)

Rumeysa Mert
Serious Game Development for AI
Passaic Valley Regional
High School, Little Falls NJ
(Little Falls, NJ)



Carter Mitchell
Cyber Security in Software
Intensive Systems
Decatur High School
(Federal Way, WA)

Benjamin Modiano
Autonomous Racecar Grand Prix
Newton South High School, MA
(Newton, MA)

Amal Mohamed
Designing for Assistive Technologies
John D. O'Bryant School of
Mathematics and Science, MA
(Roxbury, MA)

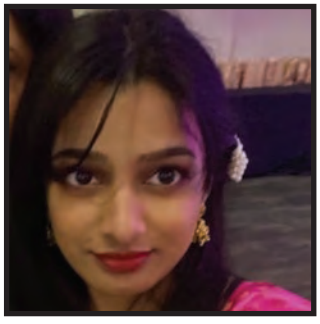
Sumaya Mohamed
Designing for Assistive Technologies
Edward M. Kennedy Academy
for Health Careers
(Boston, MA)

Ayushi Mohanty
Medlytics
Carnegie Vanguard High School
(Houston, TX)

Jennifer Mori
Autonomous Cognitive Assistant
Palo Alto High School, CA
(Palo Alto, CA)

Andrew Moses
UAS-SAR
School of The Future
(New York, NY)

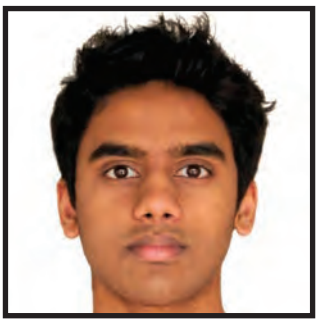
Lea Muminovic Hadzic
Remote Sensing for
Disaster Response
Palo Alto High School, CA
(Palo Alto, CA)



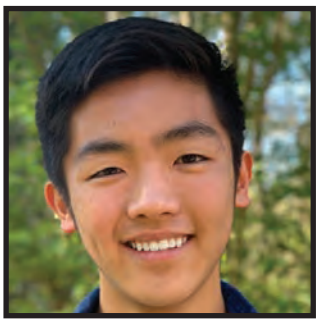
Ranvitha Muramreddy
Build A Cubesat
Linn Mar Highschool
(Marion, IA)

Shivatmica Murgai
Remote Sensing for Disaster Response
The International School of Bangalore
(Bangalore, Karnataka)

Mihir Nagarkatti
Serious Game Development with AI
Acton-Boxborough
Regional High School
(Acton, MA)



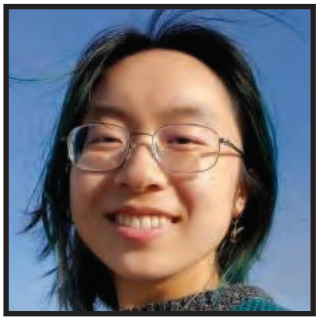
Vishnu Nair
Remote Sensing for Disaster Response
Mission San Jose High School, CA
(Fremont, CA)



Yujiro Nakano
Medlytics
Indian Springs School
(Indian Springs, AL)

Shruti Narwaney
Cyber Security in Software
Intensive Systems
Mountain Vista High School
(Highlands Ranch, CO)

Nathan Neidigh
Build A Cubesat
South Lancaster Academy
(Lancaster, MA)

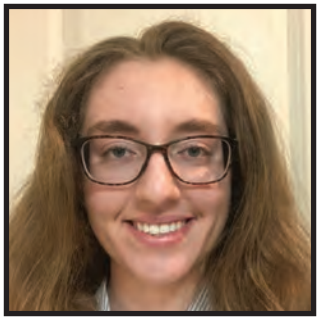


Christiana Nguyen
Designing for Assistive Technologies
Quincy High School
(Quincy, MA)

Brian Ni
Cyber Security in Software
Intensive Systems
Troy High School, CA
(Fullerton, CA)

Johnny Ni
Cyber Security in Software
Intensive Systems
Troy High School, CA
(Fullerton, CA)

Neil Noronha
Build A Cubesat
Rye Country Day School, NY
(Rye, NY)

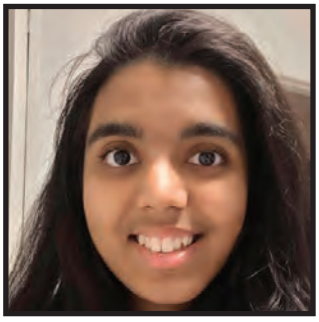


Lillian Nove
Underwater Autonomous Vehicle
Challenge (AUV)
Jordan High School
(Fulshear, TX)

Avaneesh Pal
Autonomous Air Vehicle Racing (UAV)
Ronald Reagan High, San Antonio TX
(San Antonio, TX)

Aprameya Pandit
Build A Cubesat
North Attleboro High School
(North Attleboro, MA)

Nishad Pandya
Medlytics
Lee County High School
(Leesburg, GA)



Dhatri Parakal
Remote Sensing for Disaster Response
Thomas Jefferson High School, VA
(Alexandria, VA)

Vraj Parikh
Underwater Autonomous
Vehicle Challenge (AUV)
Manheim Township High School
(Lancaster, PA)

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BASIS Independent Silicon Valley, CA
(San Jose, CA)

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Harker School, CA
(San Jose, CA)

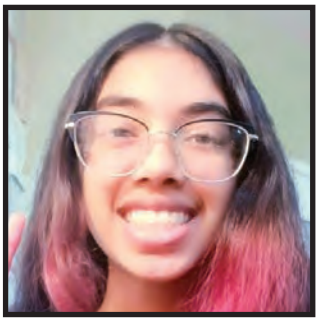
Rishi Peddakama
Autonomous Racecar Grand Prix
Del Norte High School, CA
(San Diego, CA)

Venkata Anjani Shravika Pendyala
Quantum Software
Alpharetta High School
(Alpharetta, GA)

Jiankun Peng
Serious Game Development for AI
St. Joseph's Preparatory School
(Philadelphia, PA)

Steven Pereanu
Serious Game Development for AI
Dominion High School
(Sterling, VA)

Harsha Pillarisetti
Quantum Software
Dougherty Valley High School, CA
(San Ramon, CA)



Isabelle Pinto
Build A Cubesat
Los Osos High School, CA
(Rancho Cucamonga, CA)

Supawat Pitaknarongphorn
Autonomous Air Vehicle Racing (UAV)
Troy High School, CA
(Fullerton, CA)

Isha Prem
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Governor School @ Innovation Park
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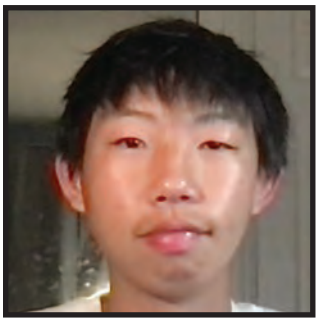
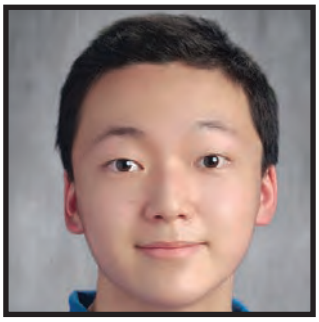
Sebastian Pujet
Serious Game Development with AI
Fairview High School
(Boulder, CO)

Sanjana Pulaparthi
Medlytics
Westborough High School, MA
(Westborough, MA)



Andrew Qin
Underwater Autonomous Vehicle
Challenge (AUV)
Cupertino High School, CA
(Cupertino, CA)



Jason Qin
Quantum Software
Illinois Math & Science Academy, IL
(Aurora, IL)

Zhixiang Qiu
Autonomous Racecar Grand Prix
Los Gatos High School, CA
(Los Gatos, CA)

Viplove Rahate
Autonomous Cognitive Assistant
Canyon Crest Academy, San Diego CA
(San Diego, CA)

Rhea Rai
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Lebanon Trail HS, TX
(Frisco, TX)

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Disaster Response
Newton North High School, MA
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UAS-SAR
Lightridge High School
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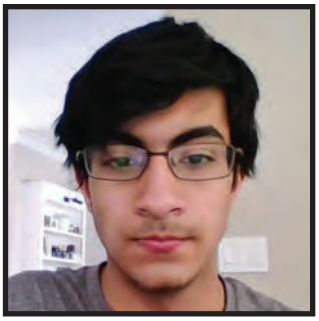
Intensive Systems
American High School, CA
(Fremont, CA)

Unsh Rawal
Autonomous Racecar Grand Prix
Unsh Rawal D Rawal
(Houston, TX)

Nihitha Reddy
Medlytics
Tahanto Regional High School
(Boylston, MA)

Logan Reich
Underwater Autonomous
Vehicle Challenge (AUV)
Hunter College High School, NY
(New York City, NY)



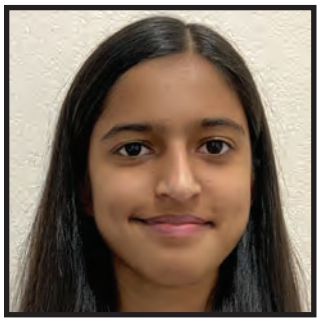
Zayn Rekhi
Autonomous Air Vehicle Racing (UAV)
Millburn High School
(Millburn, NJ)

Shaunak Rembhotkar
Remote Sensing for
Disaster Response
Burlington High School, MA
(Burlington, MA)

Jack Rimel
Embedded Security and
Hardware Hacking
NYC School
(New York, NY)

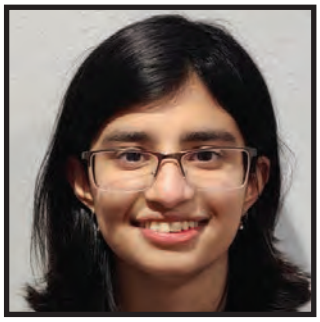
Grant Sackmann
Quantum Software
Governor's School for
Science & Mathematics, SC
(Hartsville, SC)

Neil Sash
Medlytics
Episcopal Collegiate, AR
(Little Rock, AR)



Aneeka Sawarkar
Autonomous Racecar Grand Prix
Washington High School, CA
(Fremont, CA)

Roman Sejnoha
Serious Game Development for AI
Lexington High School MA
(Lexington, MA)



Navya Seth
Autonomous Racecar Grand Prix
American High School, CA
(Fremont, CA)

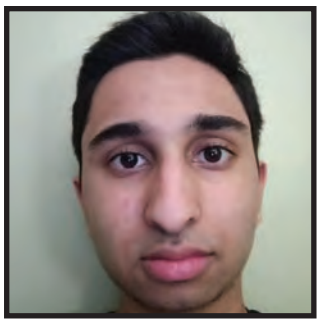
Piyush Sethy
UAS-SAR
Saint James School
(Hagerstown, MD)

Ava Shah
UAS-SAR
Mission San Jose High School, CA
(Fremont, CA)

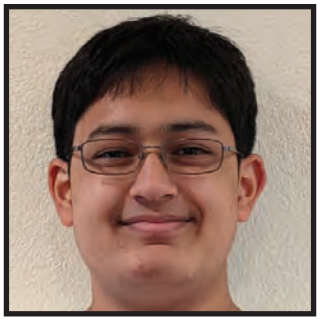
Niyati Shah
Cyber Security in Software
Intensive Systems
Scotch Plains-Fanwood High School
(Scotch Plains, NJ)

Romil Shah
Cyber Security in Software
Intensive Systems
The Hill School
(Pottstown, PA)

Jayashabari Shankar
Autonomous Cognitive Assistant
Hillcrest High School
(Midvale, UT)



Shivnath Shankar
UAS-SAR
Algonquin Regional High School, MA
(Northborough, MA)



Tanay Sharma
Embedded Security and
Hardware Hacking
Harker School, CA
(San Jose, CA)

Tanaya Sharma
Autonomous Cognitive Assistant
North Creek High School
(Bothell, WA)

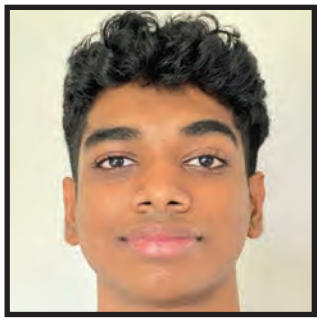
Ilia Sharonov
Embedded Security and
Hardware Hacking
Arlington High School, MA
(Arlington, MA)

Karen Shekyan
Quantum Software
Stuyvesant High School, NY
(New York City, NY)

Gracie Sheng
Autonomous Air Vehicle Racing (UAV)
Massachusetts Academy of
Math & Science, MA
(Worcester, MA)

Elisabeth Shin
Remote Sensing for Disaster Response
Andover High School, MA
(Andover, MA)

Madeline Shin
Remote Sensing for Disaster Response
Andover High School, MA
(Andover, MA)



Swas Shiv
Autonomous Racecar Grand Prix
Northwood High School, CA
(Irvine, CA)

Neta Shubin
Medlytics
Eastside Preparatory School, WA
(Kirkland, WA)

Nikil Shyamsunder`
Remote Sensing for Disaster Response
John Handley High School
(Winchester, VA)

George Simmons
UAS-SAR
Governor's School for
Science & Mathematics, SC
(Hartsville, SC)

Grant Sims
Build A Cubesat
Harker School, CA
(San Jose, CA)

Shreya Singh
Medlytics
Centerville High School, OH
(Centerville, OH)

Shalin Sinha
Build A Cubesat
Lexington High School MA
(Lexington, MA)

Rohan Siva
Remote Sensing for Disaster Response
Dougherty Valley High School, CA
(San Ramon, CA)

Foster Smith
Quantum Software
Foster Smith
(Helena, MT)

Kai Song
Autonomous Racecar Grand Prix
Tenafly High School, NJ
(Tenafly, NJ)

Selina Song
Designing for Assistive Technologies
Irvington High School
(Irvington, CA)

Sol Song
Serious Game Development for AI
Thomas Jefferson High School, VA
(Alexandria, VA)

Niyathi Srinivasan
Medlytics
Lexington High School MA
(Lexington, MA)

Raghav Srinivasan
Underwater Autonomous Vehicle
Challenge (AUV)
Rye Country Day School, NY
(Rye, NY)

Pranav Subbarayan
Autonomous Cognitive Assistant
Adrian Wilcox High School
(Santa Clara, CA)

Ananya Subramanyam
Remote Sensing for Disaster Response
San Mateo High School
(San Mateo, CA)

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Designing for Assistive Technologies
Thomas Jefferson High School, VA
(Alexandria, VA)

Michelle Sun
Quantum Software
Illinois Math & Science Academy, IL
(Aurora. IL)

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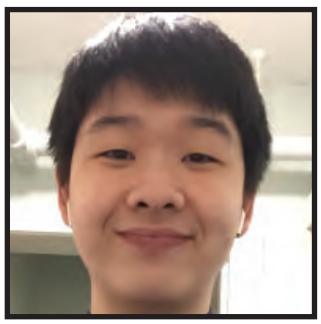
Hardware Hacking
Ronald Reagan High, San Antonio TX
(San Antonio, TX)

Chirapon Taepaisitphongse
Cyber Security in Software
Intensive Systems
The Taft School
(Watertown, CT)

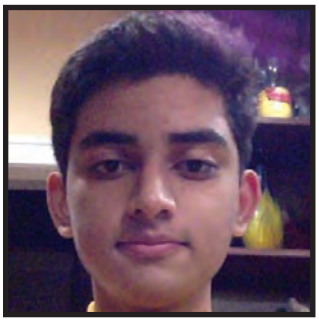


Pran Taepaisitphongse
Designing for Assistive Technologies
Concord Academy
(Concord, MA)

Ranchida Taepaisitphong
Medlytics
Middlesex School, MA
(Concord, MA)

Jamie Tan
Autonomous Cognitive Assistant
Massachusetts Academy of
Lynbrook High School, CA
(San Jose, CA)

Jiafeng Tang
Autonomous Racecar Grand Prix
Manhasset Secondary School, NY
(Manhasset, NY)

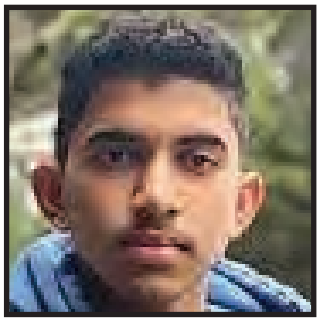


Mihir Tatavarti
Embedded Security and
Hardware Hacking
Algonquin Regional High School, MA
(Northborough, MA)

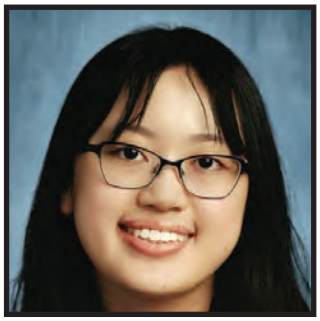
Kshitij Teotia
Medlytics
Evergreen Valley High School,
San Jose CA
San Jose, CA)

Nevin Thinagar
Build A Cubesat
Shrewsbury High School, MA
(Shrewsbury, MA)

Edward Thomas
Designing for Assistive Technologies
Hinsdale South High School
(Darien, IL)

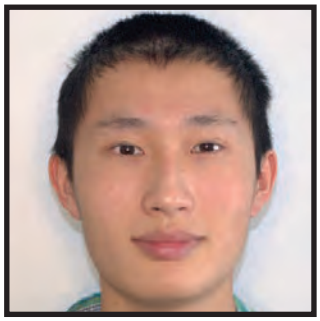


Joshua Thomas
Autonomous Racecar Grand Prix
Archbishop Mitty High School
(San Jose, CA)



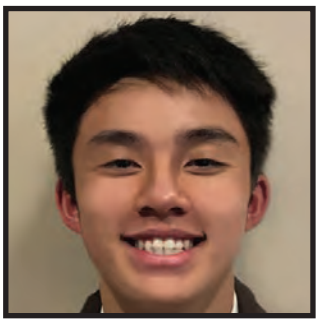
Christine Tian
Medlytics
Liberty Arts and Science Academy, TX
(Austin, TX)

Kanishk Tihaiya
Build A Cubesat
Edwin O. Smith High School
(Storrs, CT)



Alexander Tong
Build A Cubesat
Andover High School, MA
(Andover, MA)

Johnathan Tong
UAS-SAR
Thomas Jefferson High School, VA
(Alexandria, VA)



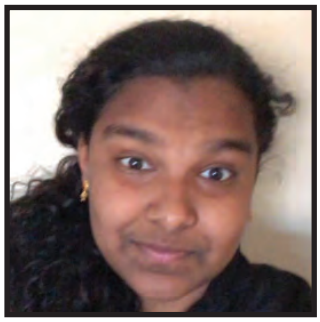
Adrian Tran
Autonomous Air Vehicle Racing (UAV)
Fairfield Warde High School
(Fairfield, CT)

My Thu Trinh
Quantum Software
Malden High School
(Malden, MA)

Alexander Tsai
Serious Game Development for AI
Hunter College High School, NY
(New York, NY)

Aishwaryaa Udeshi
Underwater Autonomous Vehicle
Challenge (AUV)
Dulles High School
(Sugar Land, TX)

Veronica Vacaras
Cyber Security in Software Intensive Systems
Nicolae Balcescu High School
(Str. Constanta nr.6, Cluj-Napoca)



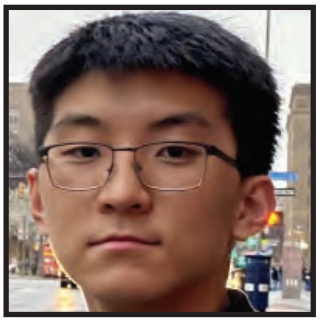
Vibusha Vadivel
Quantum Software
Agoura High School, CA
(Agoura Hills, CA)

Akshay Vemulapalli
Medlytics
Allen High School, TX
(Allen, TX)

Medha Venkatapathy
Remote Sensing for Disaster Response
Redmond High School, WA
(Redmond, WA)

Maanasa Viswanath
Autonomous Racecar Grand Prix
Henry M. Gunn High, Palo Alto CA
(Palo Alto, CA)

Eric Vo
Autonomous Air Vehicle Racing (UAV)
Oxford Academy, CA
(Cypress, CA)



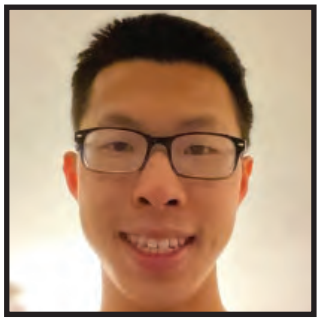
Alan Wang
Autonomous Cognitive Assistant
Farmington High School
(Farmington, CT)

David Wang
Medlytics
Groton School
(Groton, MA)

Derek Wang
UAS-SAR
University High School, CA
Irvine, CA

Jake Wang
UAS-SAR
Cupertino High School, CA
(Cupertino, CA)

Jessie Wang
Build A Cubesat
BASIS Independent Silicon Valley, CA
(San Jose, CA)



Jonathan Wang
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Algonquin Regional High School, MA
(Northborough, MA)

Katherine Wang
Autonomous Cognitive Assistant
Los Altos High School, CA
(Los Altos, CA)

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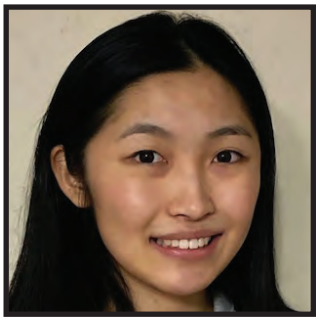
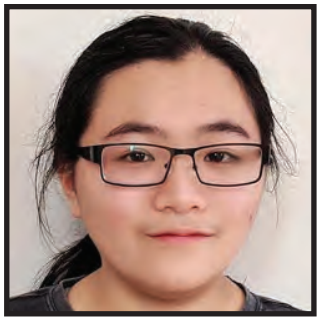
Skyline High School, WA
(Sammamish, WA)

Tina Wang
Quantum Software
Marquette High School
(Chesterfield, MO)

Holly Weber
Designing for Assistive Technologies
Homeschool
(Huntsville, AL)



Audrey Wei
Quantum Software
Newton South High School, MA
(Newton, MA)



Lily Wei
Serious Game Development for AI
Lexington High School MA
(Lexington, MA)

Tyler Westland
Medlytics
Concord Carlisle High School, MA
(Carlisle, MA)

Shane Williams
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Challenge (AUV)
Ann Arbor Huron High School
(Ann Arbor, MI)

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Build A Cubesat
Camas High School, WA
(Camas, WA)

Yuanfeng Wu
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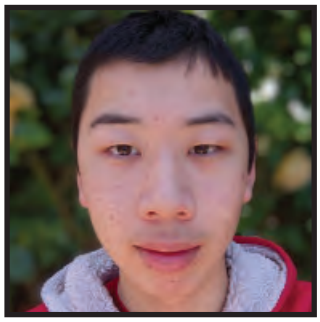
Snowden International School
(Boston, MA)

Elaina Xiao
Designing for Assistive Technologies
Elaina Xiao
(Makanda, IL)

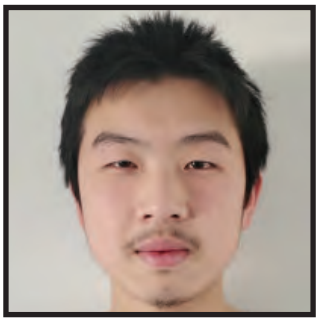
Ziqian (Alice) Xiao
UAS-SAR
Deerfield Academy
(Deerfield, MA)

Felix Xie
UAS-SAR
Northwood High School, CA
(Irvine, CA)

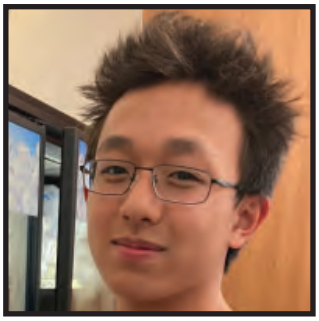
Bernard Xu
Underwater Autonomous Vehicle
Challenge (AUV)
Westwood High School, MA
(Westwood, MA)



Stephen Xu
Embedded Security and
Hardware Hacking
Canyon Crest Academy, San Diego CA
(San Diego, CA)

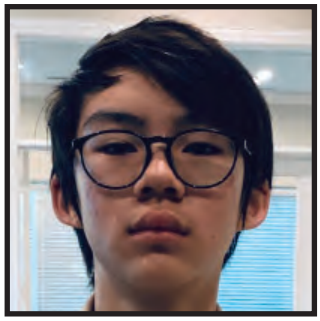


Wenbo Xu
Embedded Security and
Hardware Hacking
Novi High School
(Novi, MI)



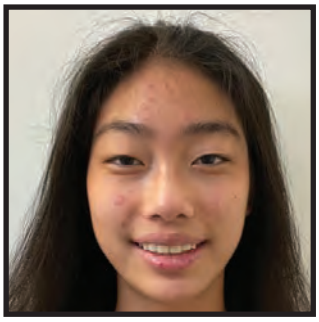
Aaron Yang
Autonomous Cognitive Assistant
North Oconee High School
(Bogart, GA)

Catherine Yang
Underwater Autonomous Vehicle
Challenge (AUV)
East Brunswick High School
(East Brunswick, NJ)



Christian Yang
Designing for Assistive Technologies
Trinity Christian Academy Addison
(Addison, TX)

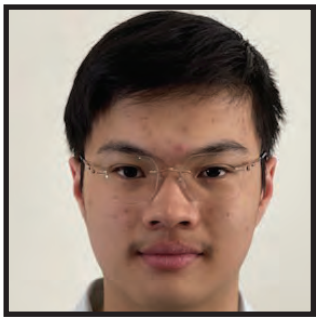
David Yang
Autonomous Cognitive Assistant
San Mateo High School
(San Mateo, CA)



Eleanor Yang
Remote Sensing for Disaster Response
Evergreen Valley High School, San Jose CA
(San Jose, CA)

Jenna Yang
Quantum Software
California Academy of
Mathematics and Science, CA
(Carson, CA)

Jessica Yang
Underwater Autonomous Vehicle
Challenge (AUV)
Bronx High School of Science, NY
(Bronx, NY)



Nicholas Yap
Cyber Security in Software
Intensive Systems
Parsippany High School
(Parsippany, NJ)

Gavin Ye
Designing for Assistive Technologies
Columbia Grammar & Preparatory School
(New York, NY)

Warren Yun
Embedded Security and
Hardware Hacking
Bronx High School of Science, NY
(Bronx, NY)

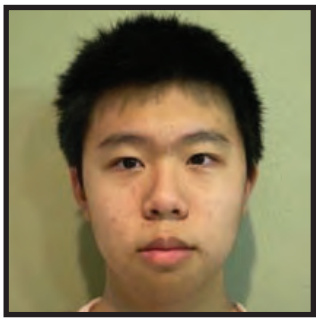
Alex Yung
Autonomous Air Vehicle Racing (UAV)
Thomas Jefferson High School, VA
(Alexandria, VA)

Derek Zang
Embedded Security and
Hardware Hacking
Stuyvesant High School, NY
(Manhattan, NY)

Eloise Zeng
Autonomous Cognitive Assistant
Wellesley High School, MA
(Wellesley, MA)

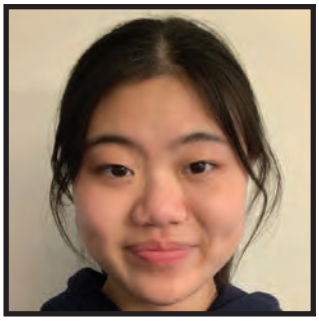
Luca Zerega
Autonomous Cognitive Assistant
Evanston Township High School, IL
(Evanston, IL)

Ada Zhang
Underwater Autonomous Vehicle
Challenge (AUV)
North Allegheny Senior High School, PA
Pittsburgh, PA)



Alex Zhang
Cyber Security in Software
Intensive Systems
Clements High School, TX
(Sugar Land, TX)

Angelina Zhang
Autonomous Racecar Grand Prix
Corona del Sol
(Tempe, AZ)

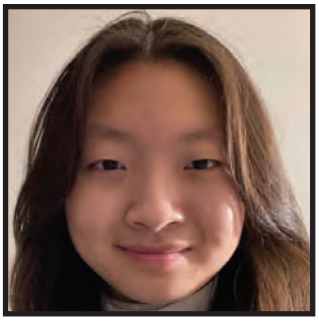


Ashley Zhang
Autonomous Racecar Grand Prix
Lexington High School MA
(Lexington, MA)

Sophia Zhang
Autonomous Racecar Grand Prix
International School
(Bellevue, WA)

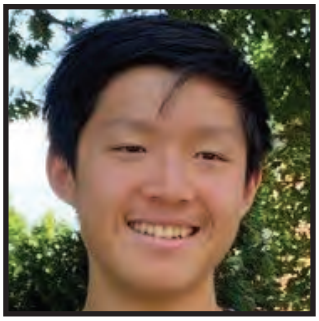
Tiankuo Zhang
Autonomous RACECAR
Bronx High School of Science, NY
(Bronx, NY)

Wanying Zhang
Embedded Security and
Hardware Hacking
Noble and Greenough High School
(Dedham, MA)



Sophia Zhao
Serious Game Development for AI
William Fremd High School
(Palatine, IL)

Emma Zheng
Embedded Security and
Hardware Hacking
Wayzata High School
(Plymouth, MN)



Patrick Zheng
Autonomous Air Vehicle Racing (UAV)
Highland Park High School
(Highland Park, NJ)

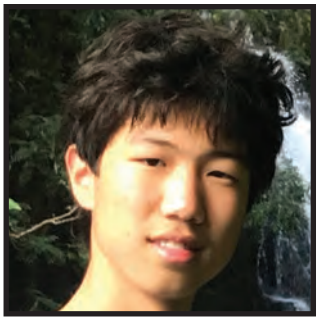
Benjamin Zhou
Autonomous Cognitive Assistant
Anderson High School
(Cincinnati, OH)

Hannah Zhou
Serious Game Development for AI
Holliston High School
(Holliston, MA)

Tony Zhou
Build A Cubesat
Valley Christian High School, CA
(San Jose, CA)

Hannah Zook
Designing for Assistive Technologies
Potomac Falls High School
(Sterling, VA)

Mohammad Zoraiz
Quantum Software
Mayfield High School
(Mayfield, OH)



Zonghao Zou
Serious Game Development for AI
Brookline High School, MA
(Brookline, MA)

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