# Logos/cis-logo-exports-final-8-2015-3/Web/2_Department_Lockups/InformationScience/cis-infosci-2-color.pngMaster of Professional Studies in Information Science

# Sponsored Project Proposal Form – Spring 2018

Please complete the following project proposal form to sponsor an MPS Project. This form will be used to determine if your project is appropriate for MPS students and whether it is of sufficient scope for a semester long project (~400-500 person-hours). We will assign teams with complementary skills based on the skills and experience you list in this form. We will also share most of this form with the students to help them make their top project choices before we assign the projects.

Please direct any questions to the MPS Project Coordinator: [is-mps-projects@cornell.edu](mailto:is-mps-projects@cornell.edu)

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| Sponsor Name | | The MITRE Corporation | | | | | | Date | 11/14/17 |
| Contact Name(s) | | Matthew Kuzdeba,  Curtis Watson,  David Slater | | | Email(s) | [mkuzdeba@mitre.org](mailto:mkuzdeba@mitre.org), [cmwatson@mitre.org](mailto:cmwatson@mitre.org), dslater@mitre.org | | Phone | 781-271-5647,  781-271-6322,  703-983-5544 |
| Description of the Sponsor | | | | | | | | | |
| MITRE is an independent, not-for-profit organization that operates research and development centers for the federal government. MITRE provides research and development, design and prototyping of new technologies, systems engineering expertise, and information technology support to government agencies, which include the Department of Defense, Department of Homeland Security, Federal Aviation Administration, Internal Revenue Service, Department of Veterans Affairs, Office of the U.S. Courts, Department of Health and Human Services, and Intelligence Agencies. Our promise to customers is that we will deliver the best solutions to their most complex technical and operational problems—with only one outcome in mind—supporting their mission. Our principal locations are in Bedford, MA, and McLean, VA, with more than 60 sites worldwide. More information about MITRE can be found on our website at: <http://www.mitre.org>  MITRE hopes that these projects expose students to interesting topics that they might continue to work as an intern or full time employee of MITRE. Due to the nature of MITRE’s work, please note the following: We cannot hire individuals that require sponsorship currently or in the future. Most projects at MITRE require a security clearance. For those positions, individuals must be a US citizen to obtain a clearance. | | | | | | | | | |
| Please indicate which academic year and semester you would like to propose your project. | | | | | | | | | |
| Year | 2018 | | Semester | Fall | | Spring |  | | |
| Project Title | | | | | | | | | |
| RF Signal Recognition with Machine Learning | | | | | | | | | |
| Project Goal or Description | | | | | | | | | |
| The goal of this project will be for students to investigate how to detect, recognize, and characterize unknown radio frequency (RF) communications signals by leveraging machine learning techniques. This is an important step towards the development of future cognitive radios that are able to autonomously establish a communications link and determine the best parameters to communicate in a congested electromagnetic spectrum, as well as providing an ability to monitor the electromagnetic spectrum and determine what other systems are operating in it. Advances in machine learning and software defined radio (SDR) have shown promise towards being able to solve this problem.  This project will be able to leverage previous MPS project work in this area from the Fall 2017 semester for background and a starting point. This project will involve investigating and implementing additional machine learning approaches to the previous work, as well as further maturing promising techniques. The algorithms can be tested out against an initial library of RF signals, as well as against a larger library of signals being developed as part of a similar Master’s project in the Electrical & Computer Engineering (ECE) Department. The signals generated by the ECE department may also include the effects of communications channel impairments which will distort the received RF signals, to see how the signal recognition algorithms can handle them. | | | | | | | | | |
| What activities are necessary to achieve the project goal? | | | | | | | | | |
| A library of RF signals with different types of modulation, bandwidths, and frequencies will either be generated or provided to the student project team. The team will be responsible for determining an approach to identify and characterize the different signals across an operating frequency band, and then implement that approach in software of their choice, such as MATLAB or Python. The team will develop and implement machine learning techniques to automatically detect and classify the signals. One set of known signals will be used for training the machine learning algorithms. A second set will then be used for testing how well the approach works on unknown signals.  A related ECE Master’s project will be using software defined radios (SDRs) to generate a library of RF signals, which can also be used to train and test against to evaluate how well the techniques work across different datasets. The ECE provided signals may contain additional RF channel effects as well to test against more realistic signals that could be seen in a wireless environment. | | | | | | | | | |
| What outcome would determine that the project is a success? Do you expect specific deliverables? | | | | | | | | | |
| The expected deliverables for the project will include a final presentation, project report, and delivery of the code developed for the project.  Since this is a challenging problem, it is not expected that the student team will fully solve it and have a polished, completed product at the end. The goal is for the team to methodically develop and demonstrate approaches that show incremental improvements, and highlight areas worth investigating further in the future as well as lessons learned. | | | | | | | | | |
| What are the skills and experience must the students already know to start work on the project?  Please be specific and keep in mind that students will be building their skills during the duration of the project. | | | | | | | | | |
| Required skills for this project, which can be learned during the initial phase if needed, include machine learning, software development, and some signal processing.  -Machine learning knowledge will be needed to understand, implement in software, train, and test different machine learning techniques.  -Signal processing knowledge will be needed to understand how to distinguish between different signal modulation techniques, and how to distinguish between different signals across an operating frequency band of interest.  -The approaches will be implemented and tested in software of the student team’s choice, which could be MATLAB, Python, or another language. | | | | | | | | | |
| What are the skills and experience required to complete the project that the students may learn while completing the project? | | | | | | | | | |
| The students will learn more in depth knowledge of machine learning and practical applications of it. They will also learn fundamental signal processing skills, along with some information about communications systems and RF channel effects. | | | | | | | | | |
| The project representative must be available 30 minutes per week for status reports, the interim report, and the final presentation. As the project sponsor, are you able to make this time commitment?  Yes. Please elaborate. | | | | | | | | | |
| We’ll be available as needed for meeting with the team remotely and answering questions over email, similar to our time commitment on the Fall 2017 MPS project. We will review and provide feedback on status and other reports/presentations as well. | | | | | | | | | |
| Some sponsors may choose to spend additional time with the student teams, e.g. phone contacts for monthly status discussions, reviewing research results, providing midpoint project feedback, and offering input to the final deliverables in advance of its completion. As the project sponsor, are you available to participate in these or any additional activities?  Yes. Please elaborate. | | | | | | | | | |
| See above response. | | | | | | | | | |
| The project representative needs to facilitate access to company resources as needed and approve expenses. As the project sponsor, are you able to facilitate access to such resources, should the need come up?  Yes. Please elaborate. | | | | | | | | | |
| If the need comes up, we’ve done this for other projects with Cornell in the past. | | | | | | | | | |
| Please consider other contributions listed below. Are you willing to make these contributions? (check all that apply)  Provide existing industry and company data as background at the beginning of the project.  Pay one or more team members to travel to your location for initial briefing / work session / final presentation.  Please elaborate. | | | | | | | | | |
| For the second item, in the past we’ve been able to provide Cornell a small amount of funding to cover the team visiting MITRE for their final presentation. We would look into that option in this case as well if there is interest. | | | | | | | | | |
| Please send your completed project proposal to the MPS Project Coordinator: [is-mps-projects@cornell.edu](mailto:is-mps-projects@cornell.edu) | | | | | | | | | |