

# Image Recognition Student Challenge

*THE VALUE OF PERFORMANCE.*  
***NORTHROP GRUMMAN***

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# Proposal

- Create a student software/algorithm challenge based on automatic Image Recognition
  - MATLAB Image Processing Toolbox
- Provide a competition framework, grading rubric, and mentors to help form teams along in process
  - Radar Systems, Electro Optic / Infrared (EOIR), Automatic Target Recognition (ATR) Engineering Northrop Grumman mentors
  - University of Maryland Electrical Engineering Professor Mentor
- Have a judging and networking event at end to network with University of Maryland Faculty and Northrop Grumman Personnel
  - One University of Maryland Judge, one Northrop Grumman Judge



# Proposed Image Recognition Challenge

- Provide students with a number of video files to automatically recognize certain objects in a frame
  - Example: Highlight Firetruck or Ambulance on stretch of road with other cars
- With student's software, perform runs against various video files, with both have and do not have the target of interest
- Award points for various categories per run
  - If target was detected properly
  - Detection of centerpoint of target (in pixel coordinates)
  - How quickly they were able to process the video to find the target
  - Number of frames in which they successfully identified the target
  - Subtract points for false alarms
- Presentation to judges (30 % of score)

# Proposed Audience and Learning

- Relevant Student Audience and Advertising Opportunities
  - Main Audience: ECE and Computer Science Students
    - Advertise in Signal Processing Courses (e.g. ENEE 322, 324) and relevant Capstones
  - Secondary Audience: Mathematics and Physics Majors
    - Advertise in Harmonic Analysis courses
  - Tertiary Audience: All Engineering Students
    - Advertise in MATLAB and Programming courses
- Potential Learning Impact for Students:
  - Will allow for an introduction to advanced image processing techniques to motivated students (typically a graduate level topic)
- Relevant image processing techniques:
  - Pattern Recognition (Gradient Matching)
    - Used in target tracking, overall image recognition
    - Creating pattern definition for required target
  - Machine Learning approaches to image recognition
  - Multi-frame image recognition (video tracking)
  - Optical Character matching (i.e. potentially find target by looking for “FIRE” on side of truck)

# Example Video Details

- Multiple videos will show fire trucks at various angles, positions, and speeds
  - Both on road and off
  - Both responding to incidents (stopped, performing firefighting) vs. just simply driving
- Team must be able to determine where and the center pixel of the vehicle for each frame it is in
  - Video does not need to be played back in real time – can be quicker (or slower technically)
  - Points given for how quickly the target can first be found (in real time, not video time)

# Team Deliverables

- Code: Software Application to perform automatic image detection and location of a specific target (70% of score)
  - Software must be created in MATLAB (even playing field in terms of speed)
  - Any toolbox may be used (that students have access to via virtual computer lab / student copy)
  - Tests will all be performed on one platform, with the test videos being locally placed on the machine (even playing field)
- Presentation: A ten minute presentation showing the techniques and algorithms performed (30% of score)
  - To be judged by one UMD, one NGMS judge
  - Scored by technical merit, innovation, and level of effort

# Image Recognition Schedule

- Preliminary Schedule (tentative):

- Info Session 1 & 2: 9/6, 9/13
- Applications Due: 9/18
- Kickoff: 9/24
- Midpoint Mentor Meeting: 10/17
- Competition/Technical Judging: 11/5
- Exposition: 11/8

- 6 Weeks work time

## Fall Semester 2018

First Day of Classes	August 27 (Monday)
Labor Day	September 3 (Monday)
Thanksgiving Recess	November 21-25 (Wednesday-Sunday)
Last Day of Classes	December 10 (Monday)
Reading Day	December 11 (Tuesday)
Final Exams	December 12-18 (Wednesday-Tuesday)
Commencement - Main Ceremony	December 18 (Tuesday)
Commencement - College/Department Ceremonies	December 19 (Wednesday)

UMD Academic Calendar

# Implementation

- Have applications for teams
  - Allow up to ten teams to participate
- Hold a kickoff meeting to form teams of participants
  - Teams of three to six
- Time to work
  - Suggesting ~six week work time, with mentors available by phone/email, in person 3 times (start, middle, end)
- Technical test performed before exposition
  - Code submitted by students
  - All run on same platform to eliminated bias in terms of network connection, individual hardware
- Have a Hackathon Exposition
  - Presentation to judges



# Team Applications

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- List Members of Team
- List Interest and Background Experience
  - Engineering, physics, programming skills
  - Why do you want to compete?
- Judged Applications
  - Feasibility of completion
  - Desire to compete
- Inform Accepted Groups