

Northrop Grumman Fall Student Challenge 2021 – Multiple Maritime Target Optical Tracking



Information Session

Agenda

- Introduction to Northrop Grumman
- Challenge Description
- Schedule
- Administrative
- Resources
- Meet and Greet

Challenge Background

- Sensors of all types depend on target tracking to keep a history of and predict future movement of a target
 - Radar Trackers for Aircraft and Ship movement
 - Acoustic trackers for undersea wildlife and submarines
 - Optical trackers for camera systems
- Target trackers come in many types
 - Kalman Filter Target Trackers
 - Machine Learning Tracker models
 - Alpha Beta (known also as f-g) Radar Detection/Object tracker
- Multiple Optical Target Tracking is a non-trivial task
 - Image occlusions and reflections
 - Multiple angles of a detected target
- **Challenge – create a target tracker to keep track of multiple ships in a video**

Challenge Description

- The task will be performed using MATLAB (and available toolboxes) or Python (and publicly available toolboxes)
- The teams will be given a catalogue of training data that simulates real world data
 - Video files, defined resolution and frame rates – Up to 20 ships per video
- An in depth explanation and materials regarding Image processing concepts will be given in order to help teams – no target tracking experience is required
- Teams of two to four undergraduates may apply to compete



Competition Overview

- Create an application that can identify, keep track of, and classify vessels in a scene
 - Keep an accurate frame by frame catalogue of maritime vessels
 - Classify into Civilian Vessel, Warship, Aircraft Carrier, Submarine
- Project Deliverables:
 - Application to test in real life test
 - Processing block diagram and report
 - Final Presentation (10 mins. w/ Q&A)
- Resources
 - MATLAB/Python Image processing and target tracking toolboxes
 - UMD Mentor
 - Northrop Grumman Mentor
 - Short Course and Resources related to Image Signal Processing and Target Tracking

Preliminary Schedule

All Events will be Virtual (Zoom)

October 07 – Kickoff

By October 10 – Final Output Interface Given

By October 11 – Sample File Set 1 Given

October 12 - Short Course on Object Tracker Types – Pros/Cons in OpenCV

October 22 – Mentor Midpoint meeting

By October 24 – Sample File Set 2 Given

November 5 (11:59PM) – Applications and Presentations Due

November 11 – Exposition

Judging and Scoring

Two aspects of the competition:

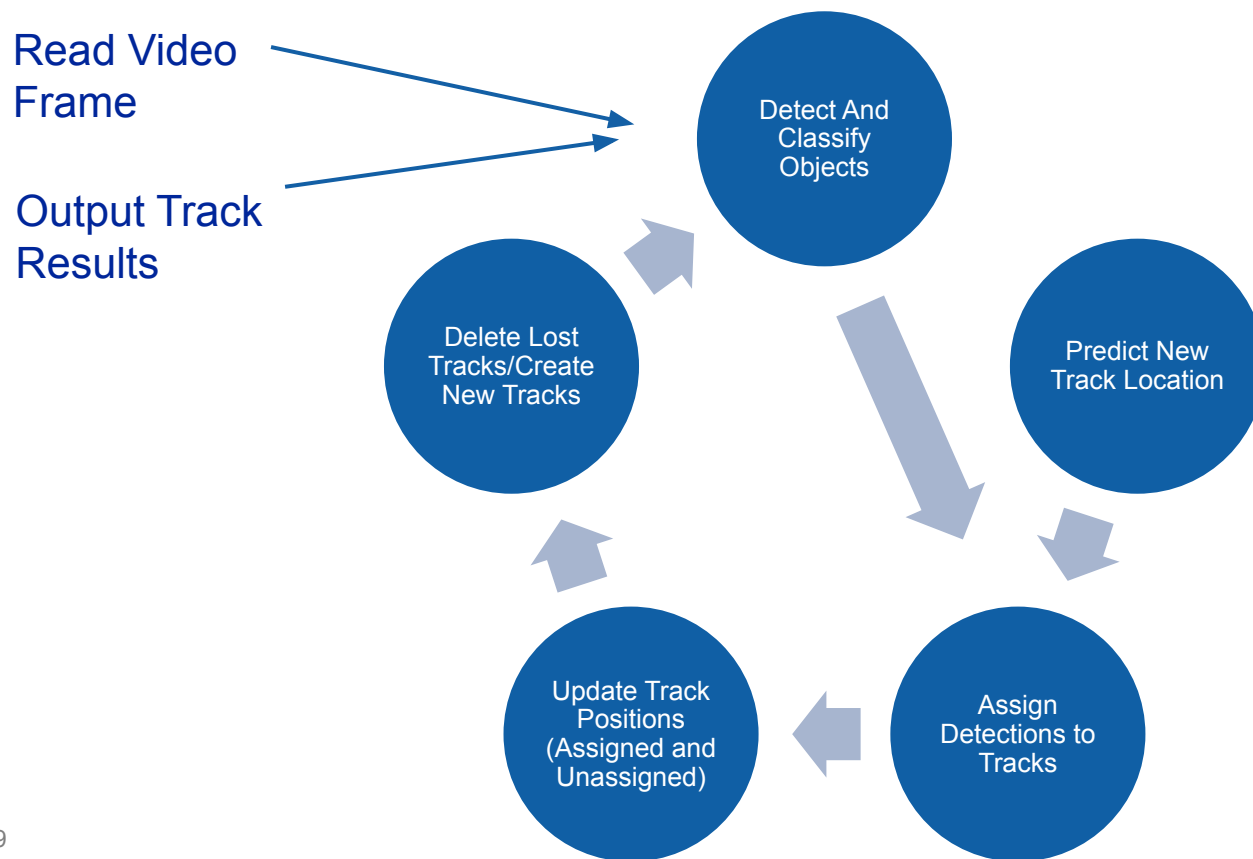
- (70%) Real life test: Teams will test their app in a real world test
 - We will test each team's applications versus videos of real life maritime traffic
 - Points will be given for correctly identifying and keeping track of each vessel for >90% of the frames that they are in
 - Additional Points will be given for correctly identifying type of vessel (only must be done once during time vessel is in the footage)
- (30%) Innovation and Presentation
 - Teams will give a presentation to the Judges outlining their signal processing architecture and techniques
 - Points will be awarded for innovation, ingenuity, and overall technical achievement
 - UMD Judge Tom Goldstein Associate Professor of Computer Science
 - Northrop Grumman Judge Paul Ledbetter, Director for Mission Engineering and System Architecture

Judge Panel to consist of UMD Faculty and Northrop Grumman Employees

Mentoring

- Each team will be assigned a Northrop Grumman mentor
 - Suggest a teleconference every 2 weeks, email/informal call in between
- Ways your mentors can help:
 - Provide insight into Northrop Grumman business/application areas (Northrop Grumman mentor)
 - Provide feedback on designs or technical questions
 - Discuss common design considerations
- Feeling stumped? Ask your mentor!

Initial Tracking Resources – Basic Tracker Diagram



Initial Tracking Resources

[Motion-Based Multiple Object Tracking - MATLAB & Simulink \(mathworks.com\)](#) – Example for Multiple Object Tracking

