2018 TRIDENT SCHOLAR PRESENTATIONS

APRIL 27, 2018
RICKOVER 103
0750-1150, 1250-1520

MIDN 1/C Michael D. Walker
Apr 27 | 0750

A Partially Premixed Combustion Application for Power Improvement in Military Diesel Engines

Diesel engine power is limited by soot formation, an indicator of incomplete combustion. Partially Premixed Combustion allows for better mixing of the air and fuel in the cylinder by delivering additional fuel through the air intake system, allowing for increased power. This project characterizes power gains in a flexible research engine, a Yanmar generator, and the HMMWV "Humvee" engine.

MIDN 1/C John J. Brough III
Apr 27 | 0820

Assessment of Genetic Screening in the Military

The goal of this project was to undertake a cost-benefit analysis of genetic testing in military populations. We considered the monetary and psychological costs and benefits of testing through the use of large genomic databases, logistic regression, a cost-benefit simulation, and a survey.

MIDN 1/C David J. Liedtka III
Apr 27 | 0850

Prediction of Voting Outcomes Using Heterogeneous Collective Regression

Link-based data is becoming increasingly important in many contexts. This project studies how algorithms for such data can be extended to produce "Heterogeneous Collective Regression" (HCR). We use HCR to predict the outcomes of Swiss referendums, and demonstrate that HCR yields high accuracy with greater efficiency vs. previous work.

MIDN 1/C Casey R.O. Densmore
Apr 27 | 0920

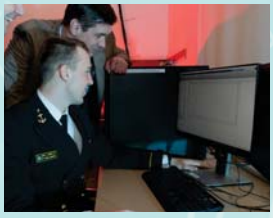
Exploring the Propagation of the Madden-Julian Oscillation Across the Maritime Continent

Differences in large-scale specific humidity and height were explored for four types of the tropical Madden-Julian Oscillation (MJO) moving through the Maritime Continent. MJO events that remain active are initially more humid than those which become inactive. MJO amplitude change is also impacted by the slower-evolving stratospheric Quasi-Biennial Oscillation (QBO).

MIDN 1/C Fernando R. Vale-Enriquez
Apr 27 | 0950

SMT Solving with a Partial Theory Solver

The complexity of theories such as real numbers hinders the practicality of SMT Solvers. We propose a modified model which incorporates a partial theory solver which solves many problems very quickly. We seek to dramatically reduce the time required to do satisfiability solving on short yet algebraically complex problems.



MIDN 1/C John J. Gainer Jr.
Apr 27 | 1020

Persistent Target Detection and Tracking by an Autonomous Swarm

This project employs a swarm of limited endurance autonomous vehicles to detect and track multiple targets in a defined search environment. The swarm conducts persistent operations by extending existing solutions for multivehicle operations to account for limited agent endurance constraints and utilize a decision-making model to coordinate and assign operational modes.

MIDN 1/C Benjamin R. Dunphy
Apr 27 | 1050

Magnetotransport Properties of Shallow Quantum Well Structures for Spintronic Applications

Layered materials, such as heterostructures based on InAlSb/InAs/AlGaSb quantum wells hold great promise for many applications, including spintronics. Optimal injection and detection of the spin currents requires placing the InAs layer near the surface. We study the effect of surface proximity to assess their potential for spintronic applications.

MIDN 1/C Carter B. Burn
Apr 27 | 1120

Human Aided Reinforcement Learning in Complex Environments

Reinforcement learning algorithms enable computer programs (agents) to learn to solve tasks through a trial-and-error process. This project expands current systems by introducing a human expert to the learning process. Using the novel techniques of Time Warp and Curriculum Development, we found that this improved both speed and performance of the agent in completing the task.

MIDN 1/C Gregory E. Hyer
Apr 27 | 1250

A Microlensing Analysis of the Central Engine in the Lensed Quasar WFI J2033-4723

We report a detection of microlensing variability in 12 seasons of optical imagery of the lensed quasar WFI J2033-4723 from the Chilean 1.3m SMARTS and the 1.5m EULER telescopes. Using Monte Carlo methods, we analyze this variability to yield the first-ever measurement of the size of this quasar's accretion disk.

MIDN 1/C Michael J. Wallace
Apr 27 | 1320

Innovations to Increase the Power of State-of-the-Art Graph-Theoretic Two-Sample Statistical Tests

Two-sample statistical testing is very challenging in high dimensions and few standard methods exist. Largely enabled by improvements in computing power, recent developments in the area of nonparametric statistics and graph-theoretic tests offer novel solutions to these types of problems. We seek to extend existing methods and achieve improved results.

MIDN 1/C Carl C. Kolon
Apr 27 | 1350

Stability of Nonlinear Swarms on Flat and Curved Surfaces

We investigate long-term stability of a swarm of self-propelled identical agents in flat space, with spring-like attraction. We extend this model to curved spaces using concepts from differential geometry. We then implement our results in a high-fidelity robotics simulator.

MIDN 1/C Christopher G. Cantillo
Apr 27 | 1420

Assessing the Transient Gust Response of a Representative Ship Airwake using Proper Orthogonal Decomposition

Landing Naval aircraft at sea is a hazardous, unpredictable operation due to effects of the highly complex and unsteady superstructure airwake. Using wind tunnel Particle Image Velocimetry, a representative ship model was exposed to simulated transient gusts, and the never-before-seen turbulent airwake effects were quantified to better understand the phenomenon.

MIDN 1/C Dakota J. Allen
Apr 27 | 1450

Evaluation of Non-Oxide Fuel for Fission-based Nuclear Reactors on Spacecraft

The objective of this project is to research uranium based non-oxide fuels for use in a nuclear reactor intended for space. This project will evaluate the reactor criticality and the reactor power over a 15 year lifetime.