Projects Day 2017

Celebrating 54 Years of Excellence

Tuesday, May 2 10:30 a.m.-6 p.m.



Clinic Program

Projects Day is dedicated to
Jack Alford and Mack Gilkeson
for their foresight and
wisdom in the creation of the
Harvey Mudd College Clinic Program

Mission Statement:

Harvey Mudd College seeks to educate engineers, scientists, and mathematicians well versed in all of these areas and in the humanities and the social sciences so that they may assume leadership in their fields with a clear understanding of the impact of their work on society.

47th Annual Projects Day

The Computer Science, Engineering, Global, Mathematics, and Physics Clinics of Harvey Mudd College are pleased to present the work of our students.

Geoff Kuenning, Director Computer Science Clinic

Kash Gokli, Director Engineering Clinic

Qimin Yang, Associate Director Engineering Clinic

Susan Martonosi, Director Global Clinic

Weiqing Gu, Director Mathematics Clinic

Richard Haskell, Director Physics Clinic

Harvey Mudd College PROJECTS DAY May 2, 2017

Program

10:30 a.m Registration and Poster Viewing Platt Campus Center

1:00 p.m. General Session Shanahan Center 1430

Welcome - Maria Klawe, President

Remarks - Geoff Kuenning, Director, Computer Science Clinic

Milestone Awards - Jeffrey Groves, Dean of the Faculty Recipients:

Amazon.com, Inc.

HRL Laboratories, LLC Microsoft Corporation The MITRE Corporation

Northrop Grumman Corporation

1:30 - 3:00 p.m. Project Presentations See Schedule

3:00 - 3:30 p.m. Break Shanahan Center:

1st Floor North Terrace & Thomas Garrett Plaza

3:30 - 5:00 p.m. Project Presentations See Schedule

5:15 - 6:00 p.m. Poster Reception Platt Campus Center

Guests, Faculty, and Students

Schedule of Presentations

Project Tir			me			Location	
	1:30	2:00	2:30	3:30	4:00	4:30	SHAN
BIOLOGY/COMPUTER SCIENCE/ MATHEMATICS CLINIC Dart NeuroScience Creation and Analysis of Experiment Driven Biological Networks for Understanding Memory Processes	X				X	X	3465
COMPUTER SCIENCE CLINIC							
American Express Hotel Recommendation System	X		X	X			B-470
Big Fish Games, Inc.	X		X	X			2461
Measuring User Engagement in Fairway Solitaire	**			**	**		2.407
FICO Using Latent Topics Models to Detect Rare Behaviors	X			X	X		2407
GoDaddy		X			X	X	B-470
Dynamic Website Updates Google, Inc.		X			X	X	2461
Serializing Chromium Tab State		Λ			Λ	Λ	2401
International Business Machines Corporation (IBM)				X	X	X	B-442
Cognitive Note Taking Laserfiche		X	X			X	2407
Fast Detection of Problems in Scanned Documents							
Lawrence Livermore National Laboratory High Performance Portability				X	X	X	2440
MITRE	X	X	X				B-442
Image De-Identification	x						2460
New Relic, Inc. New Relic Churn Prediction & Prevention —		X				X	2460
Micro-Segmentation and Predictive Analytics							
Proofpoint Prodicting Malicious UPLs	X			X		X	3460
Predicting Malicious URLs Reddit		X	X		X		3461
Detecting Evil Through Machine Learning							
Webroot Real-Time Visualization and Machine Learning On			X	X	X		2460
Network Streams							
COMPUTER SCIENCE/							
ENGINEERING CLINIC							
ZAM Helmets, Inc.		X		X	X		2475
Hockey Helmet Impact Monitoring System							

Building Codes:

SHAN = Shanahan Center for Teaching and Learning

Note: The "B" in room numbers indicates "Basement Level."

ENGINEERING CLINIC The Acrospace Corporation One TFLOP/s GPU on an Aerocube Picosatellite Amazon Lab126 Configurable Microphone Harness Array Arronic Create a Visual Production Scheduling System X	Project			Ti		Location		
The Aerospace Corporation One TFLOP/s GPU on an Aerocube Picosatellite Amazon Lab126 Configurable Microphone Harness Array Arconic Create a Visual Production Scheduling System AT&T RF Drones for Automated Signal Analysis BD Biosciences Improving Ease and Efficiency of Blood Sample Manipulation for Flow Cytometry Verification City of Hope Redesigning the Lighting and Optics for Laparoscopic Surgery City of Hope A Raman Spectrometer for in vivo Cancer Assessment Dolby Laboratories, Inc. FPGA Implementation of HEVC Decoder HP, Inc. Clear Fluid Detection on Media Intuitive Surgical, Inc. Providing Aerial Views During Minimally Invasive Surgery Microsoft Surface RF Propagation in Buildings Mission Rubber Company Energy Monitoring System for Industrial Rubber Molding MIT Lincoln Laboratory Adaptive Wireless Sensing Motiv Power Systems Heat Pump for Heavy Electric Vehicles Niagara Bottling, LLC Rotation Speed of Blow Molding Equipment Northrop Grumman Corporation Secure State Estimation Regenesis Biomedical New Form Factor and User Interface Techmation Project Beluga: Trajectory-Tracking Controller for Autonomous Underwater Vehicles Toyota Energy Usage and Efficiency in a Fuel Cell Electric Semi-Trailer Truck Triple Ring Technologies IoT Mobile Health Monitoring		1:30	2:00	2:30	3:30	4:00	4:30	SHAN
The Aerospace Corporation One TFLOP/s GPU on an Aerocube Picosatellite Amazon Lab126 Configurable Microphone Harness Array Arconic Create a Visual Production Scheduling System AT&T RF Drones for Automated Signal Analysis BD Biosciences Improving Ease and Efficiency of Blood Sample Manipulation for Flow Cytometry Verification City of Hope Redesigning the Lighting and Optics for Laparoscopic Surgery City of Hope A Raman Spectrometer for in vivo Cancer Assessment Dolby Laboratories, Inc. FPGA Implementation of HEVC Decoder HP, Inc. Clear Fluid Detection on Media Intuitive Surgical, Inc. Providing Aerial Views During Minimally Invasive Surgery Microsoft Surface RF Propagation in Buildings Mission Rubber Company Energy Monitoring System for Industrial Rubber Molding MIT Lincoln Laboratory Adaptive Wireless Sensing Motiv Power Systems Heat Pump for Heavy Electric Vehicles Niagara Bottling, LLC Rotation Speed of Blow Molding Equipment Northrop Grumman Corporation Secure State Estimation Regenesis Biomedical New Form Factor and User Interface Techmation Project Beluga: Trajectory-Tracking Controller for Autonomous Underwater Vehicles Toyota Energy Usage and Efficiency in a Fuel Cell Electric Semi-Trailer Truck Triple Ring Technologies IoT Mobile Health Monitoring	ENGINEERING CLINIC							
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Improved Cryogenic Institution System	improved Cryogenic institution system							
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Project Time Location

2:00 2:30

3:30 4:00

4:30

SHAN

ENGINEERING/MATHEMATICS X X X 3485 Genentech Optimized Emergency Power Management Planning X Niagara Bottling, LLC X X B-460 Capping Accuracy of Highspeed Lightweight Bottling Lines ENGINEERING/PHYSICS CLINIC X X X Sandia National Laboratories B-454 Measuring the Permittivity of Ferroelectric Nanoparticles in an Epoxy Composite GLOBAL CLINIC X X X 2465 **Kaiam Corporation** High Throughput Laser Diode Burn-in Systems MATHEMATICS CLINIC EDR, Inc. X X X 1480 Document Mining and Analysis on Environmental Reports Saracen Energy X X X 1480 Reverse-Engineering Power Flows on the Eastern Interconnect from Real-Time Price Data SoCalGas X X X 3465 Evaluation and Optimization of SoCalGas Routing Planning and Algorithms PHYSICS CLINIC X HRL Laboratories, LLC X X B-454 Automated Tuning of Electrostatically Defined Quantum Dots: Navigating Through High-Dimensional Potential Energy Landscapes

CLINIC ADVISORY COMMITTEE OF HARVEY MUDD COLLEGE

Industry Members:

Paul Anderson, *The Aerospace Corporation* Michael Bell, *Beckman Coulter, Inc.*Joseph Betser, *The Aerospace Corporation* Daniel A. Borton '90, *Amgen Inc.*Bob Butterfield, *BD*Carl Carrera, '75/76, *The Boeing Company* Frances Ferris '80, *The Boeing Company* David Lesyna, *Optivus Proton Therapy, Inc.*John Livingston, *Tandem Diabetes Care* Hal Lonas, *Webroot, Inc.*John McNeil '89, *John McNeil & Co., Inc.*Elly Schofield '13, *Harvey Mudd College* Craig Snow, *Raytheon Missile Systems*

College Members:

Maria Klawe, President
Dan Macaluso, Vice President, College Advancement
Jeffrey Groves, Vice President, Dean of the Faculty
Andrew Dorantes, VP for Administration & Finance/Treasurer
Scott Martin, Assistant VP for Business Affairs & Assistant Treasurer
Barry Olsan, Director, Corporate Relations
Geoff Kuenning, Director, Computer Science Clinic
Kash Gokli, Director, Engineering Clinic
Qimin Yang, Associate Director, Engineering Clinic
Susan Martonosi, Director, Global Clinic
Weiqing Gu, Director, Mathematics Clinic
Richard Haskell, Director, Physics Clinic

Personalized Projects Day Schedule

Please fill in the empty slots below with the presentations you would like to attend.

Time	Event	Location
10:30 a.m.	Registration and Poster Viewing	Platt Campus Center
1:00 p.m.	General Session	Shanahan Center 1430
1:30 p.m.		
2:00 p.m.		
2:30 p.m.		
3:00 p.m 3:30 p.m.	Break	Shanahan Center Thomas Garrett Plaza
3:30 p.m.		
4:00 p.m.		
4:30 p.m.		
5:15 p.m 6:00 p.m.	Poster Reception	Platt Campus Center

Key to Poster Session Layout

- 1. The Aerospace Corporation
- 2. Amazon Lab126
- 3. American Express
- Arconic, Inc.
- 5. AT&T
- 6. BD Biosciences
- 7. Big Fish Games
- 8. City of Hope-Optics
- 9. City of Hope-Spectrometer
- 10. Dart NeuroScience, LLC
- 11. Dolby Laboratories, Inc.
- 12. EDR
- 13. FICO
- 14. Genentech
- 15. GoDaddy
- 16. Google, Inc.
- 17. HP, Inc.
- 18. HRL Laboratories
- 19. International Business Machines Corporation (IBM)
- 20. Intuitive Surgical
- 21. Kaiam Corporation
- 22. Laserfiche
- 23. Lawrence Livermore National Laboratory
- 24. Microsoft Surface
- 25. Mission Rubber Company
- 26. MIT Lincoln Laboratory
- 27. The MITRE Corporation
- 28. Motiv Power Systems
- 29. New Relic, Inc.
- 30. Niagara Bottling-Capping
- 31. Niagara Bottling-Blowmolding
- 32. Northrop Grumman Corporation
- 33. Proofpoint, Inc.
- 34. Reddit
- 35. Regenesis Biomedical
- 36. Sandia National Laboratories
- 37. Saracen Energy
- 38. SoCalGas
- 39. Techmation
- 40. Toyota
- 41. Triple Ring Technology
- 42. United Launch Alliance
- 43. Webroot, Inc.
- 44. ZAM Helmets, Inc.

BIOLOGY/ COMPUTER SCIENCE/ MATHEMATICS CLINIC

Dart NeuroScience, LLC

Creation and Analysis of Experiment Driven Biological Networks for Understanding Memory Processes

Liaisons: Philip Cheung '96, Amir Fayyazuddin,

Qingying Meng, Douglas Fenger

Advisors: Lisette de Pillis, Eliot Bush

Students: Loring Thomas (PM-S), Lisa Goeller,

Ellen Seidel, Rohan Shankar (PM-F)

Dart Neuroscience (DNS) is a pharmaceutical company that focuses on developing treatments for memory disorders. The goal of the clinic project was to build biological networks based on DNS experimental data and to create accompanying network analysis tools. The networks and tools will help DNS better understand memory processes and find drug targets, with the goal of improving long term memory.

COMPUTER SCIENCE CLINIC

American Express Hotel Recommendation System

Liaisons: Dawn Thomas, Di Xu

Advisor: Zachary Dodds

Students: Christine Chen (PM), Yacht Kitimoon,

Alyssa Kubota, Jon Ueki

American Express and its partners seek to make travel planning easier, quicker, and more personalized. To that end, the objective of our clinic team was to explore and extend American Express's current machine-learning based hotel recommendation algorithms with the goal of improving their performance.

Big Fish Games

Measuring User Engagement in Fairway Solitaire

Liaisons: Brad Bulkley, Chris Chatburn,

Sam Prud'homme, Michael Tapley

Advisor: Colleen Lewis

Students: Justis Allen, Michael Diamond (PM),

Adam Dunlap, Aaron Stringer-Usdan

Big Fish Games, Inc. develops the game Fairway Solitaire and cares deeply about the player experience. The goal of our project was to use machine learning on existing user data to better understand how player interaction with the game's features affects player engagement. Better understanding what makes users engage with the game would allow Big Fish Games, Inc. to make more informed design decisions.

FICO

Using Latent Topics Models to Detect Rare Behaviors

Liaisons: Scott Zoldi, Joe Murray

Advisor: Robert Keller

Students: Savannah Baron, Sneha Deo (PM-S),

Emily First (PM-F), Hope Yu

Our project's goal was to investigate the detection of rare customer behaviors in transactional data using latent topic models, a form of unsupervised machine learning typically used to detect topics in examples of natural language. Our team has developed techniques to apply these models to time series data and has assessed their viability in the detection of anomalous behaviors.

GoDaddy

Dynamic Website Updates

Liaisons: Heidi Gibson, Jacob Page, Dan Gwozdz

Advisor: Ben Wiedermann

Students: Keighley Overbay (PM-S),

Maureen Naval (PM-F), Terrence Diaz,

Linnea Nelson, Connie Wang

GoDaddy provides small business owners with the tools they need to easily host and create their own personalized websites. The goal of our project is to extend GoDaddy's website builder to allow small business owners to automatically display announcements on their websites at a predetermined time, as well as directly post these announcements to their social media accounts.

Google, Inc.

Serializing Chromium Tab State

Liaisons: Aaron Gable '12, Chris Palmer

Advisor: Beth Trushkowsky

Students: Julien Chien (PM), Zoab Kapoor,

Thomas Le, Yi Yang

Google's Chrome browser, based on the open source project Chromium, is the most widely used browser in the world. The goal of our project was to research and implement strategies for serializing the full state of a tab in Chromium so that it can be suspended and restored with minimal user-visible disruption. Our team researched and implemented strategies for serializing and restoring tabs so that Chrome users would not lose information during memory-constrained situations.

International Business Machines Corporation (IBM)

Cognitive Note Taking

Liaisons: Maria Ebling '88, John Vergo,

Michael Tanenblatt Advisor: Lisa Kaczmarczyk

Students: Scott Chow, Harry Cooke (PM),

Wyatt Cooper, Julia Cosma,

Emilia Reed

This project aims to develop a note-taking mobile application and service that acts as a personal cognitive assistant to help IBM employees extract company-specific information from their notes. The application accepts collections of documents (such as PDF files or images) and direct input to the application (such as text or handwriting). It utilizes IBM Watson cognitive services to analyze the documents and extract specific information about companies, which is then verified by the user.

Laserfiche

Fast Detection of Problems in Scanned Documents

Liaisons: Tessa Adair '14, Karl Chan '89 P19,

Carl Sykes

Advisors: Yekaterina Kharitonova.

Melissa O'Neill

Students: Tiffany Sun (PM), Kharisma Calderon,

Carmen Mejia, Andrew Scott

Laserfiche builds software that helps organizations digitize content and automate processes. To ensure that data from scanned paper documents can be accurately extracted, Laserfiche has tools to fix image quality problems such as skew and speckles. The goal of our project was to automatically and quickly detect problems in scanned documents. By detecting these problems, the software can reduce the time and processing required for image correction. Our team extracted features from a collection of scanned images and used machine learning classifiers to predict if a newly scanned document has problems.

Lawrence Livermore National Laboratory

High Performance Portability

Liaisons: Holger Jones, David Beckingsale,

David Poliakoff Advisor: Chris Stone

Students: Nick Gonzalez (PM-F),

Aaron Lobb (PM-S), Dan Obermiller

Lawrence Livermore National Lab (LLNL) uses supercomputers to perform complex physics simulations. Maintaining parallel code is difficult when faster computers with different architectures are installed every few years. Portability layers can simplify this code by hiding details of computer architecture and parallelism. The goal of the clinic team was to improve RAJA, a portability layer created and used by LLNL. The team also compared RAJA to other portability layers with respect to usability and performance.

New Relic, Inc.

New Relic Churn Prediction & Prevention — Micro-Segmentation and

Predictive Analytics
Liaisons: Kira Chuchom, Tarun Arora

Advisor: Ran Libeskind-Hadas Students: Felis Perez, Rose Choi, William Chen (PM-S), Yiqing Cai (PM-F)

The goal of the New Relic Clinic project is to develop a data-driven approach to predicting potential churn. New Relic has collected substantial data. The types of data that has been collected have varied over time, leading to a heterogeneous dataset that is difficult to analyze. To address this issue, the New Relic Clinic project aims to first restructure the data to be consistent and then apply machine learning techniques to identify features capable of predicting churn.

The MITRE Corporation Image De-identification

Liaisons: Sarah Doyle, Nick Orlans, Jay Doyle

Advisor: Lisa Kaczmarczyk

Students: Madi Pignetti (PM), Nava Dallal, Michael Sheely, Veronica Rivera

The MITRE Corporation is a not-for-profit research company that applies new technologies to problems in an array of areas. The goal of the MITRE clinic team's project is to produce an algorithm that transforms an image to preserve apparent similarity to a human, but leads to a decreased accuracy for a number of specified recognition algorithms. This algorithm makes it significantly more difficult for certain facial recognition algorithms to detect individuals, leading to increased security and privacy.

Proofpoint

Predicting Malicious URLs

Liaisons: Thomas Lynam, Mike Morris '97

Advisor: Elizabeth Sweedyk

Students: Vidushi Ojha (PM), Aidan Cheng,

Kevin Herrera, Carli Lessard

As part of their security solutions, Proofpoint provides a service to scan URLs embedded in clients' emails, and determine whether they lead to sites containing malware. Suspicious URLs are redirected to a virtual environment, or sandbox, where they are tested for maliciousness. The goal of our project is to create a machine learning classifier which can better detect malicious URLs, so that fewer URLs need to be sandboxed. We investigated various models and features to create a number of options for such a classifier.

Reddit

Detecting Evil Through Machine Learning

Liaison: N/A

Advisor: Yi-Chieh Wu

Students: Jonathan Chang (PM-S), Rachel Lee,

Anna Ma, Kent Shikama (PM-F),

Lisa Vin

Reddit is an online discussion platform where users can form communities centered around a variety of topics. Like any discussion website, Reddit has experienced instances of spam, trolling, cyberbullying, and general aggressive behaviors from users, which can alienate other users or discourage people from joining Reddit. To help Reddit combat such behavior, we created an extensible machine learning pipeline for predicting whether a comment will be perceived as aggressive.

Webroot, Inc.

Real-Time Visualization and Machine Learning On Network Streams

Liaisons: Hal Lonas, Trung Tran Advisor: Geoff Kuenning

Students: Nick Bailey (PM), Rohin Lohe,

Jeff Milling, Norwood Square

Webroot specializes in cloud-based Internet security for consumers and businesses. The goal of our project was to perform real-time machine learning on local network streams and provide insight about anomalous and malicious behavior. Our Students: Aaron Wang (TL-F), team developed an infrastructure that uses machine learning to capture and analyze network traffic and display information about it, offering clients a better understanding of malicious activity on their networks and a new way to protect against malware

COMPUTER SCIENCE/ ENGINEERING CLINIC

ZAM Helmets, Inc.

Hockey Helmet Impact-Monitoring

System

Liaison: Whitman Kwok '97 Advisor: David Money Harris Students: Lydia Scharff (TL-S),

David Tenorio (TL-F), Erin McCarthy, Matthew Williams, Zunvan Wang (S).

Kim Joly (F)

ZAM Helmets Inc. is a startup creating better hockey helmets to reduce concussions among youth players. The ZAM clinic team is building an Internet of Things impact-monitoring system for use in these helmets. The system consists of an inhelmet impact sensor array, an iPhone app for displaying data about potential concussion risk, and cloud data storage for future analysis to aid concussion research.

ENGINEERING CLINIC

The Aerospace Corporation One TFLOP/s GPU on an Aerocube

Picosatellite

Liaisons: Tim Smith '05, Alex Utter '05,

Darren Rowen, Dr. Joseph Betser

Advisor: Brian Bryce

Men Cheol Jeong (TL-S),

Lauren Hu (S), Alex Echeverria (S), Teresa Despres (F), Nancy Wei (F),

Nicholas Sakowski (F)

The Picosat program at The Aerospace Corporation designs, constructs, launches and operates small cube-like satellites for various mission concepts. The Aerospace Corporation clinic project is to build and demonstrate a picosatellite payload using the NVIDIA Jetson TX1 supercomputer-onmodule. This payload will measure the functional ability of the Jetson TX1 in a low earth orbit radiation environment. Successful demonstration of the Jetson will raise the space readiness level of this cutting-edge technology and will enable exciting future mission capabilities.

Amazon Lab126

Configurable Microphone Harness Array

Liaison: Ken Hild Advisor: TJ Tsai

Students: Paul Slaats (TL-S),

Samantha Hoang (TL-F), Rosh Lam, Eyassu Shimelis (S), Gabe Rubin (F),

Jonathan Kupfer (F)

Amazon Lab126 is a subsidiary of Amazon.com focused on development of consumer electronic products. The Amazon Lab126 Clinic team will design a configurable microphone-speaker system. It must fit into arbitrary product enclosures while supporting 16 location-adjustable microphones and computer interfacing for automated testing. The system will support stereo, mono, and 5.1-surround sound speaker outputs. This project will expedite the testing process for future prototypes in the Amazon Echo family of products with varying microphone and speaker configurations.

AT&T

RF Drones for Automated Signal Analysis

Liaisons: Terence Wu, Chuck Palaganas Advisors: Albert Dato (S), Ruye Wang (F) Students: Patrick McKeen (TL -S),

Siyi Hu (TL-F), Jesse Joseph, Ramy Elminyawi (F), Austin Shin (S),

Charles Van Eiik (F)

The AT&T Clinic project is to develop a drone-based system to collect data on over-the-air digital television signals, particularly signal strength, clarity, and orientation across location and altitude. The system will include an operating procedure, easy-to-use operation and visualization software, drone selection, and onboard hardware, as well as the reasoning behind design choices and recommendations for future improvements.

Arconic, Inc.

Create a Visual Production Scheduling System

Liaisons: Christopher Dinsley, Paul Rogers Advisors: Patrick Little. Werner Zorman

Students: Shaan Gareeb (TL-S), Katherine Yoo,

Jeong Shim (TL-F), Camille Croll (S), Anjaneya Malpani (S), Lam Huynh (F), Marissa Lee (F), Angelica Virrueta (F)

Arconic's Rancho Cucamonga facility produces aerospace parts in (Nickel, Titanium, Aluminum) and makes monthly shipments to companies across the globe. Arconic Rancho's revenue growth is being constrained by forge capacity, which prompted Rancho to engage the Harvey Mudd clinic team to develop a production scheduling system that will assist the scheduler to optimize the forge units to increase efficiency and throughput, enabling future revenue growth.

BD Biosciences

Improving Ease and Efficiency of Blood Sample Manipulation for Flow Cytometry Verification

Liaisons: Christine Paulson '02, Josh Zollett

Advisor: Gordon Krauss

Students: Lani Chapko (TL-F), Andrew Marino,

Kelly McConnell, Ruth Sung (TL-S),

Ramita Kondepudi (S), Thomas Morgan-Witts (F)

BD Biosciences' flow cytometers are crucial research and clinical instruments used in studying, diagnosing, and finding cures for today's diseases such as HIV and leukemia. Harvey Mudd College has been enlisted to help BD Biosciences' systems development team in making verification testing of their products more efficient. Our Clinic Team is focused on reducing the skill and tedious nature of whole blood specimen manipulation techniques, by providing tools to make these procedures easier, faster, and less error-prone.

City of Hope

Redesigning the Lighting and Optics for Laparoscopic Surgery

Liaisons: Dr. Kurt Melstrom, Dr. Yanghee Woo,

Dr. Yuman Fong, Dr. Mustafa Raoof

Advisor: Qimin Yang

Students: Kathryn Jones (TL-S),

Erica Martelly (TL-F),

Leonardo Huerta, Richard Liu (F), Sean Nguyen (F), Arthur Reyes (S),

Robin Bendiak (S)

Minimally-invasive (laparoscopic) surgeries currently utilize a tethered, expensive system that relies on a single hot, limited-range incandescent light attached to a lone camera. This year the team focused on designing a set of cost-effective, self-sufficient systems using modern lighting and camera systems that will provide improved visibility for surgeons.

City of Hope

A Raman Spectrometer for in vivo Cancer Assessment

Liaisons: Dr. Veronica Jones, Dr. Yuman Fong,

Dr. Dan Schmolze, Dr. Lily Lai,

Dr. Bertrum Yuh

Advisor: Philip Cha Students: Sarah Anderson (TL-S),

Connor Stashko, (TL-F), Nathan Miller,

Alex Echevarria, Willie Zuniga

The City of Hope-Spectrometer clinic team is laying the groundwork for a Raman system to assess cancer margins in vivo and in real time. The final device will be placed into the breast, liver, or prostate and, upon recognition of cancer, ablate the malignant tissue. The team's focus has been to collect and analyze spectra of human tissue to extract features that indicate if the tissue is malignant.

Dolby Laboratories, Inc

FPGA Implementation of HEVC Decoder

Liaison: Olivier Lambert Advisor: David Money Harris Students: Michael Reeve (TL-S),

> Achintaya Bansal, Bonny Chen, Joanna Ho (TL-F), Charlotte Robinson

The purpose of this project is to develop a prototype implementation of an HEVC decoder in FPGA based on a Dolby's internal "IMPACT" HEVC decoder implementation written in C-code for multi-core CPUs. The project will involve performance evaluation of the existing C-code to identify the most compute-intensive modules, and an RTL implementation of these modules.

HP, Inc.

Clear Fluid Detection on Media

Liaisons: Alyssa Siegman '13, Aaron Rosen '16,

Stephen Bauer, Mark Choy

Advisor: Nancy Lape

Students: Lucia Kaye (TL-S),

Tae Ha "Jeff" Park (TL-F), Michelle Niu, Ramonda Giddings, Jose Orozco, Kana Hatori, (KU-S),

Florence Walsh (F)

HP Inc is the worldwide leader of home, office, commercial, and industrial printing. The goal of the HP Clinic project is to detect clear fluids, which are crucial in providing durability and improving quality of printed products. By detecting the location and quantity of clear fluids in real time and in situ, the team will help reduce waste and provide more consistent printing quality.

Intuitive Surgical, Inc.

Providing Aerial Views During Minimally Energy Monitoring System for Industrial Invasive Surgery

Liaisons: Dr. Diana Friedman '04,

Dr. Andy Hazelton. Kayla Keifer Anderson

Advisor: Angie Lee '05

Students: Faith Lemire-Baeten (TL-S),

Sarah Nichols (TL-F),

Daniel Rodriguez, Tyler Smallwood,

Lupe Carlos (S). Michelle Lanterma (S), Zachary Shattler (F)

The Intuitive Surgical, Inc. Team will design, build, and test a device that works with the da Vinci Surgical System to provide a wide angle view of the patient's entire body cavity for surgeons and operating room staff during minimally invasive surgery to augment the close-up view provided by the existing endoscope. This project has three main parts; the camera, the lighting, and the casing containing both of the previous components. The main areas of work are in minimizing the device size and providing as much lighting as possible.

Microsoft Surface RF Propagation in Buildings

Liaison: Dave Neff '79 Advisor: Nassibeh Hosseini Students: Cherie Ho (TL-S).

Marisa Kager (TL-W), Olivia Schneble (TL-F), Duncan Crowley (S),

Ragini Kothari (F), Patrick Scalise (F)

Microsoft Corporation builds many wireless devices, including the Surface tablet. These devices connect to a variety of wireless networks and often operate in an interior environment where building structures (e.g. walls, floors) interfere with signal propagation. The Microsoft Surface Clinic team is characterizing the impact of interior environments (e.g. hallways, walls, floors) on RF propagation at commonly used WiFi and cellular data bands. From their experiments, the team developed a revised model for predicting path loss in a variety of indoor environments

Mission Rubber Company

Rubber Molding

Liaisons: Richard Getze, Luciana Ramirez,

Jay Clark, Don Wrixon Advisor: Matthew Spencer Students: Mark Lozano (TL-S),

> Hannah Zosman (TL-F), Huting Lin, Fernando Salud, Viviana Bermudez (F)

The Mission Rubber Company (MRC) clinic team designed an energy diagnostic and monitoring (EDM) system that measures, records, and graphically displays power used by industrial rubber presses. A prototype version of the EDM system was installed at the MRC manufacturing facility in Corona, whose annual energy use (10 GWh) could power nearly 1,000 homes. The EDM will be used to compare the operating power of different machines, recognize power inefficiencies and quantify the effects of energy reduction programs.

MIT Lincoln Laboratory

Adaptive Wireless Sensing

Liaisons: Masato Kocherber '10. Eric Storm '15

Advisor: Philip Cha

Students: Sam Dietrich (TL-S),

Orpheas Petroulas (TL-F), Jacob Nguyen, Enoch Yeo (S),

Manu Kondapi (S), James Palmer (F),

David Kwan (F)

MIT Lincoln Laboratory is a federally funded research and development center and leader in wireless technology research. The MIT Lincoln Laboratory Clinic project is to design and prototype a reconfigurable signal classification system with applications including intelligent Wi-Fi channel allocation. The team will research, develop, and characterize algorithms to discriminate between several simultaneous RF emitters and determine signal properties including carrier frequency and modulation type. Algorithms will be tested in simulation and on software-defined radios.

Motiv Power Systems

Heat Pump for Heavy Electric Vehicles

Liaisons: Jim Castelaz '06, Edmond Kwok,

Megan Peekema

Advisor: Anthony Bright Students: Emily Beese (TL-S),

Joshua Sealand (TL-F),

Jacob Knego (S), Kamau Waller (S), Sean Mahre (S), Kyla Scott (F), Bryce Murley (F), Jacey Coniff (F)

Motiv Power Systems is a provider of all-electric drivetrains for medium and heavy-duty vehicles. The goal of the Motiv clinic project is to design and test a new, more efficient thermal management system for Motiv's electric powertrains that incorporates battery heating and cooling into the current cabin AC system. This would facilitate the use of cheaper, higher performance lithium ion batteries in their electric vehicles.

Northrop Grumman

Secure State Estimation

Liaisons: Stephanie Tsuei, Ron P. Smith '83, Ken Dreshfield '80, Ian Jimenez '11

Advisor: Christopher Clark Students: Aishvarya Korde (TL-S),

Paige Rinnert (TL-F), Robert Cyprus, Zayra Lobo (F), Austin Chun (S),

Jesus Villegas (S)

Autonomous vehicle control requires estimating vehicle states from on-board sensor readings. In the case that some of the sensors are compromised, the state of the vehicle may not be accurately estimated. The goal of this Clinic project is to implement a secure state estimator (SSE) in simulation and then validate it in hardware on a low-cost quadrotor. The team will demonstrate that the addition of the SSE to the control loop reduces the real-time tracking error of a quadrotor when using measurements from compromised onboard sensors

Niagara Bottling, LLC Rotation Speed of Blow Molding Equipment

Liaisons: Alexander Mouschovias, Alberto Giron

Advisor: Hesam Moghaddam Students: Ian Song (TL-S),

Michael Chaffee (TL-F), Phuong Nguyen, Ryan Gibbs (S), Kristin Lie (S), Jose Godinez (F),

Kim Tran (F)

Niagara Bottling, LLC is the largest private bottled water manufacturer in the U.S. that is currently undergoing double digit annual growth. The HMC Niagara Blowmolding clinic project is to develop tools and processes to evaluate the electrical, mechanical, and thermal limitations of the blowmolding machines.

Regenesis Biomedical

New Form Factor and User Interface

Liaisons: Martin Kirk, Joseph Bright

Advisor: Elizabeth Orwin Students: Benjamin Kunst (TL),

> Coco Coyle (TL), Owen Morrison (S), Justin Lauw (S), Wenkai Qin (S), William Balliet (F), Christine Goins (F),

Josephine Wong (F)

The 2016-17 Regenesis Biomedical Clinic project is to design, build, and test circuitry to generate radio frequency signals in four applicator pads for the next generation Provant Therapy System. The team will design a user interface to support this function and maintain EMC compliance.

Techmation

Project Beluga: Trajectory-Tracking Controller for Autonomous Underwater Vehicles

Liaisons: Jerry Hsiung '16, Ben Chasnov '16,

Cyrus Huang '16, Yu Yang

Advisor: Anthony Bright

Students: Vaibhav Viswanathan (TL-S),

Jessica de la Fuente (TL-W), Cherlyn Chan (TL-F), Kyle Lund,

Elijah Carbanaro (F), Jessica Lupanow (S), Chris Kotcherha (S)

The HMC Techmation Clinic team will modify and build a new version of the current Beluga AUV, develop an underwater trajectory-tracking controller and demonstrate the working controller on the Beluga 2.0 in field trials.

Triple Ring Technologies IoT Mobile Health Monitoring

Liaisons: Jen Keating, Dickshitha Thyagharajon

Advisor: Brian Bryce

Students: Deval Gupta (TL-S),

Erin Paeng (TL-F), Senghor Joseph, Zane Bodenbender, Sarah Wang

Triple Ring Technologies (TRT) is an engineering consulting firm dedicated to bringing deep scientific knowledge to design of innovative medical technologies. The TRT Clinic project aims to develop a mobile health monitoring platform that can readily accommodate emerging medical sensor technologies. The platform includes data acquisition on a wearable device, data visualization and storage on an Android application, and a cloud interface. As a proof-of-concept, the platform is configured to measure heart rate via photoplethysmography.

Toyota

Energy Usage and Efficiency in a Fuel Cell Electric Semi-Trailer Truck

Liaison: Mr. Takehito Yokoo Advisor: Okitsugu Furuya

Students: Elyse Pennington (TL-S),

Cassie Burgess (TL–F), Daniel Nguyen, Aurora Leeson (S), Luis Viornery (S), Lillian Liang (F), Sarah Silcox (F)

Toyota has long maintained that hydrogen fuel cell technology could be a zero emission solution across a broad spectrum of vehicle types. The scalability of this technology is enabling the automaker to explore a semi-trailer truck application for a California-based feasibility study. The Toyota clinic project models energy usage and efficiency in the vehicle's four main subsystems, with the goal of specifying vehicle component capacities.

United Launch Alliance

Improved Cryogenic Insulation System

Liaison: Tucker Gritton
Advisor: Gordon Krauss
Students: Rachel O'Neill (TL-S),

Elizabeth Lee (TL-F), Michael Muzio, Bailey Meyer (S), Jasmine Yang (S), Isabel King (F), Richard Ni (F)

United Launch Alliance is America's ride to space and is interested in developing new technologies for space travel. The ULA clinic team seeks to identify and test potential materials for a cryogenic insulation system. The team will also create a model to predict heat transfer properties and thermal degradation of such a system.

ENGINEERING/MATHEMATICS CLINIC

Genentech

Optimized Emergency Power Management Planning

Liaisons: Jerry Meek, Chris Wimmer Advisors: Tanja Srebotnjak, Ruye Wang (F) Students: Joseph Sinopoli (TL), Eric Mueller,

Dan McCabe, Ahhyun Ahn, Andrea Vasquez (F)

Genentech is a biotechnology company researching and producing medicines for serious illnesses. Genentech is headquartered in South San Francisco, CA and is vulnerable to power outages during earthquakes. The Genentech clinic team is tasked with developing a emergency power management plan. Using operations research techniques, generator refueling and shutdown schedules for each building are generated. Displayed within Genentech systems, the plan helps facilities protect priceless research, upkeep production, and prevent inventory spoilage.

Niagara Bottling, LLC Capping Accuracy of Highspeed Lightweight Bottling Lines

Liaisons: Clemente Sanchez, Tony Peterson,

Miles Moyers, Jim Brady,

Damon Choate, Danny Weckstein,

Jim Utley, Alan Bunteman

Advisors: Kash Gokli, Talithia Williams Students: Jonathan Lum (TL -S),

Alexa Le (TL -F), Lakshay Akula,

Zachary Friedlander, Michaela Yaman (F)

Niagara Bottling, LLC is the largest family owned bottled water company in the United States, and is the largest producer of bottled water by volume. The Niagara Bottling - Capping clinic project is to understand the causes of bottle cap misapplication and reduce the misapplication frequency through conducting a Design of Experiments.

ENGINEERING/PHYSICS CLINIC

Sandia National Laboratories Measuring the Permittivity of

Ferroelectric Nanoparticles in an Epoxy Composite

Liaison: Todd Monson

Advisors: Richard Haskell, Albert Dato Students: Marisol Beck (TL-S),

Carmel Zhao (TL-F), Jonas Kaufman, Cesar Orellana, Robin Bendiak (F),

Isabel Martos-Repath (S)

Barium titanate (BTO) is a ferroelectric material commonly used in capacitors because of its high bulk dielectric constant, which may be even higher in nanoparticle form. The Sandia team is determining the dielectric constant of BTO nanoparticles as a function of particle size by measuring composites of BTO nanoparticles in epoxy. We are improving our composite fabrication procedure to reduce the agglomeration of BTO nanoparticles and using finite element analysis to extract the dielectric constant of the nanoparticles.

GLOBAL CLINIC

Kaiam Corporation High Throughput Laser Diode Burn-in Systems

Liaisons: Dr. Bardia Pezeshki '87,

Christopher Stonier,

Jacinto Dominguez, Dr. Dinh Ton, Dr. Mike Jubber, Jay Kubicky,

Derek Keir

Advisor: Matthew Spencer Students: Jeewan Naik (TL-S),

Emily Schooley (TL-F), Tommy Berrueta, Evan Kahn,

Yashas Hegde (S), Hamza Khan (F)

Kaiam Corp. is an industry leader in the field of optical communications for data centers, and rising demand has stretched its manufacturing capability. One manufacturing bottleneck is the diode burn-in process, which tests the micron scale laser diodes at high power and temperature. The Kaiam clinic project is to design a new burn-in system using micromechanical chips to make contact with the diodes and test them more quickly.

MATHEMATICS CLINIC

EDR, Inc.

Document Mining and Analysis on Environmental Reports

Liaisons: Paul R. Schiffer, Richard White,

Zach Fisk

Advisor: Weiqing Gu

Students: Vinh The Hoang (PM),

Abram Sanderson, Annaliese Johnson,

Matthew Bae, Johan Hoeger

The EDR clinic team was asked to work on a solution for EDR which would enable them to tag key pieces of information that appear in State and Federal Government environmental documents. As a major holder and distributor of environmental data, EDR desires to have a more effective method for finding desired information in these documents than their current methods allow. Since an environmental professional might be interested in multiple aspects of any given the document, the EDR team has explored classification and search techniques for both images and text in order to analyze and tag documents. The team's work will be formatted as per EDR's request, for adoption by EDR, and merging into their current systems.

Saracen Energy

Reverse-Engineering Power Flows on the Eastern Interconnect from Real-Time Price Data

Liaisons: Dr. Brian Maurizi, CMC '03,

Ross Sclafani, HMC '08

Advisor: Weiging Gu

Students: Rohan Nagpal, Ricky Pan,

Michael Rees (PM), Jincheng Wang

Independent organizations called Independent System Operators are constantly calculating how to most efficiently meet the country's demand for power. They communicate this information by publishing prices. Our team developed methods for using these prices to estimate power flows through large subsets of the U.S. power grid to better inform Saracen of the state of various lines. Knowledge of these flows will ultimately help Saracen, which trades in a market of buying and selling power, make better trading decisions.

SoCalGas

Evaluation and Optimization of SoCalGas Routing Planning and Algorithms

Liaisons: Virginia Balbo, Ludivina Michel

Advisor: Susan Martonosi

Students: Stetson Bost (PM-S), Max Howard, Yichen Lu (PM-F), Noah Marcus

SoCalGas provides natural gas services to over 20 million residents of the Southern California region. Each day, SoCalGas must generate routes to service up to 14,000 individual customer orders. The SoCalGas Clinic team worked to improve the vehicle routing process and route quality through district design and parameter optimization.

PHYSICS CLINIC

HRL Laboratories, LLC

Automated Tuning of Electrostatically Defined Quantum Dots: Navigating Through High-Dimensional Potential Energy Landscapes

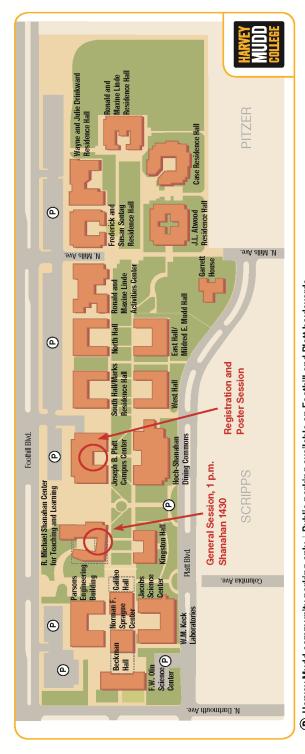
Liaisons: Matt Reed '07, Mark Gyure, Emily Pritchett, Richard Ross

Advisor: Gregory Lyzenga Students: Kathleen Kohl (TL-S),

Amy Brown (TL-F), Brynn Arborico,

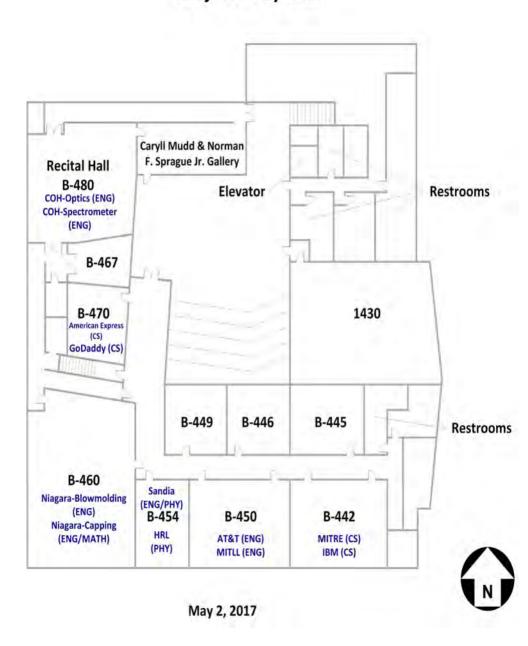
Max Byers

HRL Laboratories is a cutting-edge physical science and engineering research laboratory. The HRL clinic project aims to create a computational model which navigates through the high-dimensional potential energy landscape of a triple quantum dot system in order to automate the process of placing one electron into each quantum dot. HRL is developing these quantum dot-based devices for eventual use in quantum information processing technologies.

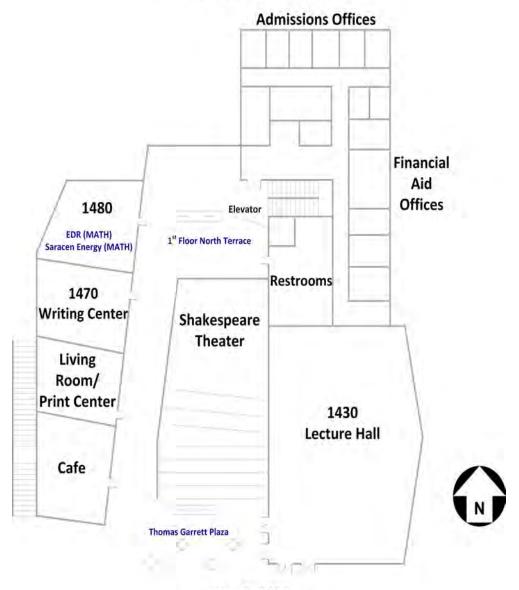


(P) Harvey Mudd community parking only | Public parking available on Foothill and Platt boulevards.

Shanahan Center for Teaching and Learning Basement Projects Day 2017

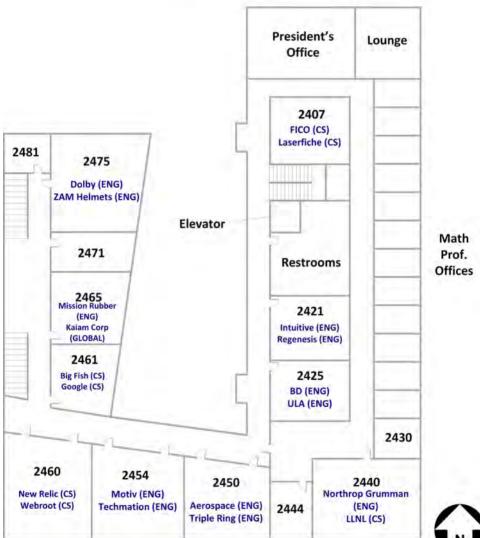


Shanahan Center for Teaching and Learning First Floor Projects Day 2017



May 2, 2017

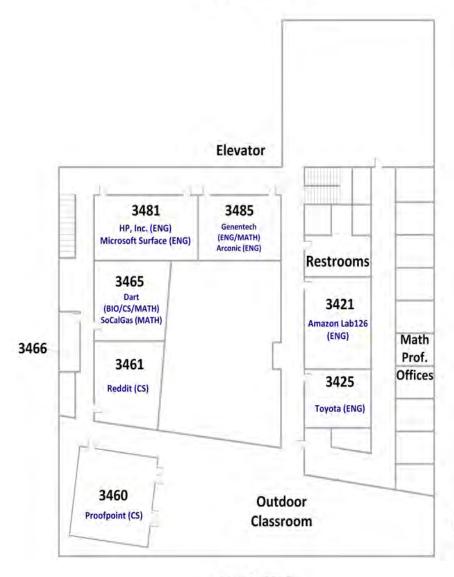
Shanahan Center for Teaching and Learning Second Floor **Projects Day 2017**





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Notes:			

Harvey Mudd's annual celebration of student achievement includes
Presentation Days (May 1 & 3, 2017),
showcasing senior thesis research and class projects, as well as
Projects Day (May 2, 2017),
showcasing projects in the Clinic program.

Acknowledgments:

To all of the many Alumni and Parents who assist in the recruitment, formulation and conduct of Clinic projects year to year, and to the Clinic Advisory Committee who provide valuable industry perspective and advice. Your continued support is greatly appreciated.

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To all Harvey Mudd College Faculty & Staff involved in the preparation of Projects Day