

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

6.UAT High School Conference

Program

THURSDAY, APRIL 5, 2018

9 AM – 2 PM

Special thanks to:

Katherine Touafek (Schools to Careers Partnership)

Regia Oneil, Jennifer Sauriol (Hamilton Wenham)

Yuri Petriv (Somerville)

Jack Gordon (MIT)

Last updated March 31

9 AM

Coffeehouse Lounge

Botnets: How to take over the world with a zombie army

Ice bear: How to promote clean energy and get paid for air conditioning simultaneously

Mathematics of music

Communicating with computers

How to make the Bayes-t guess at your secret cousin's gender

Lobdell Balcony

How computers remember everything

Finding the shortest path between two cities

Side-channel attacks: The vulnerabilities that every computer has that can't be patched

Signal Filtering: Picking the best out of a mess

Enhance: Enlarge photos without loss of quality

The key to curing cancer

Mezzanine Lounge

Genetic algorithms: Natural selection inspires problem solving

Protecting what you share online with RSA encryption

How to do subtraction... without doing subtraction

How your computer stops Netflix from deleting your college essay

Multithreading: How computers can work more efficiently

PDR 1

How Hollywood makes Superman fly

Improving computer graphics with anti-aliasing

Let's teach the computer to learn!

How do noise cancelling headphones work?

Reducing risk in investing: Overview and applications

PDR 2

Metering lights: Slower can be faster

Nerve regeneration

Collision detection with sweep and prune: The hard problem in making video games

BitTorrent: File sharing is caring

Getting a computer to group our everyday things

PDR 4

How do we know what our genes do?

Counting bunnies

How to get selfish people to cooperate using game theory

Are you still watching? How to find the most binge-worthy movies on Netflix

Spelling the genetic story of you

Getting computers to understand human language

Cardinal

Neena Dugar (15)*

Meia Alsup (15)

Sarah Antiles (15)

Hayley Bergman (15)

Bryson Galapon (15)

Remi

Angie Boggust (12)*

Dian Mattingly (13)

Kade Phillips (12)

Shang-Yun Wu (12)

Slava Kim (12)

Jisoo Min (12)

Jorg

Chris Larry (7)*

Efe Akengin (7)

Olivia Brode-Roger (7)

Marco Cunqueiro (7)

Ronald Dentinger (7)

Drew

Samantha Fierro (5)*

Jini Gabbidon (5)

Christina Ji (6)

Venita Boodhoo (5)

Benjamin Kaplan (5)

Michelle

Brian Xie (7)*

Rishi Shah (7)

Malcolm Wetzstein (7)

Jennifer McCleary (14)

Zachary Collins (13)

Jason

Priya Pillai ((4)

Nestor Chachamis (6)

Eleanor Pence (6)

Rachel Groberman (4)

Darian Bhatthena (4)*

Wesley Runnels (4)

9 AM (cont.)

Twenty Chimneys

Consensus: Getting friends to finally agree on something
How to find cute cats: A guide to object recognition
Kruskal's algorithm: Finding the cheapest way to connect houses
To infinity, and what's beyond
The magic behind solid-state drives

West Lounge

Make up your mind! An introduction to decision probabilistic trees
Hashing your hash browns
That's not yours: Labeling information to protect from hackers
Locking a bathroom door with text messages
Sound synthesis: Making music with math

Shaiyan

Kelvin Lu (22)*
Diego Lazares (22)
Jason Lam (21)
Melanie Chen (22)
Faaya Fulas (21)

Anu

Guilio Capolino (15)*
Ellen Shea (15)
Jennifer Switzer (15)
Alap Sahoo (5)
Timothy Chong (14)

10 AM

Coffeehouse Lounge

Predicting patterns for guessing games
How do computers do it all... and not mess up?
How to become a matchmaker
Bloom filters: The internet's silent defenders
Card tricks for mathematicians: A matching problem

Lobdell Balcony

Gradient descent
Surfing the dark web
TBD
How to use the moon as a communications satellite
Quantum computer
Excuse me, where's my website?

Mezzanine Lounge

Ctrl-X, Ctrl-V: Can we edit ourselves?
How to safely store passwords
Pipelining: What do laundry and computer processors have in common
Seeing fast and far: RADAR fundamentals
Turning things on and off really fast
Why are cell phone screens so good now?

PDR 1

Building the blockchain: How cryptocurrencies work
When random guessing works: The beauty of Monte Carlo methods
The cookie monster paradigm: Greedy is good
Hacking 101: Buffer overflows
Reading your dog's mind with probability: Introduction to prediction things with math

Cardinal

Rodrigo Carrillo-Sanchez (16)*
Daniela Carrasco (16)
Joanna Cohen (16)
Robert Durfee (16)
Lilia Poteat (16)

Long

Luke Luneau (25)*
Felipe Moreno (25)
Theron Nipson (25)
Daniel Sheen (25)
Zijin Shi (25)
Tiffany Yang (12)

Jorg

Nana-Efua Essuman (8)*
Janice Chui (8)
Thomas Dudzik (8)
Matthew Hutchinson (8)
Scott McCuen (8)
Cory Johnson (23)

Linda

Michael Sanabria (19)*
Yun-Ta Tsai (19)
Linda Gong (22)
Justin Restivo (19)
Josh Hellerstein (5)

*: slide collector, (n): section number, ((n)): first half presenter, (n)): second half presenter

10 AM (cont.)

PDR 2

What can evolution make?
How to always win at Rock, Paper, Scissors
Consensus: How to agree, for computers
Solving seemingly impossible problems? Use Fermi estimation!
How computers communicate
How to solve any maze using depth-first search

PDR 4

It's lit: An overview of HDR imaging
How to live forever: Cancer cells and immortality
NMR spectroscopy: How to use magnets to identify almost anything
Which clique will the new girl join? K-nearest neighbors and classifying data
Birthday paradox

Twenty Chimneys

Making Mike Wazowski
Achieving a goal accurately and quickly by using the past, present, and future
How to guess a number within 7 tries
Expectation: A mathematician's guide to winning the lottery
Fixing mistakes using error correcting codes
Learning Pacman: The human way

West Lounge

Floyd-Warshall: The next best thing after teleportationmck
Gel electrophoresis: Sorting DNA and solving crime
Collaborative filtering: Netflix's secret to success
How hard is it to find people sharing a birthday?
The magic of memory: A smarter way to handle big problems

Michelle
Magnus Johnson (8)*
Chris McKinney (8)
Gina Yuan (8)
Kevin Weng (1)
Catherine Yao (1)
Zhaoyuan Zhang (1)

Amar
Casey Hong (1)*
Haley Abramson (1)
Chiho Im (1)
Madison Lee (1)
Sydney Volanski (1)

Shaiyan
Celine Qiu (19)*
Raphael Chang (19)
Nancy Luong (19)
Katherine Mathison (19)
Tara Liu (21)
Kevin Lyons (21)

Anu
Karunya Sethuraman (16)*
Sara Tollestrup (16)
Emily Weng (16)
Siqi Chen (13)
Sunny Tian (13)

11 AM

Coffeehouse Lounge

The Rabin-Karp algorithm: Why you shouldn't plagiarize
Counting past infinity
Sine + Sine = Music? How to model the sound of a musical note by summing sine waves
Bootstrapping data: Coming to conclusions by resampling the data
How to bake bread assembly line style

Mezzanine Lounge

Huffman encoding: Efficiently translating English to binary
How to better your odds of winning a game show
Information encoding: How much can you say with just 1's and 0's?
How to find the shortest route without using Google
Anti-aliasing: How computers display images clearly
Bluetooth is better because...

Cardinal
Harrison Kaplan (17)*
Adam Katz (17)
Richard Oates (17)
David Pineiro (17)
Katherine Prutz (17)

Jorg
Mustafa Ben (9)*
Kathleen Brandes (9)
Shavina Chau (9)
Jakub Chudik (9)
Kainin Tankersley (9)
Ryan Welch (23)

*: slide collector, (n): section number, ((n): first half presenter, (n)): second half presenter

11 AM (cont.)

PDR 1

Feedback control: Learning from errors
Linear algebra: A geometric approach
Given Hayley is a MIT varsity swimmer, is she from Massachusetts?
Gambler's ruin
What's inside a transistor: How it works explained in 10 minutes or less

Drew
Daibo Chen (9)*
Scott Viteri (9)
Yida Wang (9)
Christabel Sitienei (24)
Mark Vrablic (24)

PDR 2

Saving money with the Bellman-Ford algorithm
The double-slit experiment: Understanding strange properties of electrons
Google Flights: Finding the cheapest route to fly from Boston to Seattle
Cheating, but not: How to go deeper in neural networks
How to capture 3D shapes
Recursion: Solve the problem with the problem

Luis
Julia Fiksinski (11)*
Matthew Khoury (11)
Stephen Li (11)
Andrew Luo (11)
Tomohiro Maeda (11)
Nanette Wu (13)

PDR 4

MiniMax: Keeping the odds in your favor (for two player games)
Hacking the iPhone: Using bugs in the system to run your own software
Autocomplete: How Google finishes your _____
Bringing Baymax to life
Keeping your internet experience more private, secure, and unlimited

Amar
Tara Smith (2)*
Collin Fijalkovich (2)
Audrey Li (2)
Rhea Lin (2)
Victoria Ouyang (2)

Twenty Chimneys

How to be the perfect matchmaker: A guide to love using the stable marriage problem
Piecey palindromes with DP
Approaches to generating random numbers
Building models that generalize: How to filter out the noise in your data
Counting candy with MapReduce
Quadrees: How to check if many objects collide with each other (fast)

Shaiyan
Amanda Li (24)*
Elizabeth DeTienne (24)
Yota Kato (24)
Pedro Mantica (24)
Jocelyn McGhee (24)
Matthew Pfeiffer (24)

West Lounge

CRISPR: How to hack your DNA
Optical illusions for robots
Routing protocols, or the inner workings of the internet as whole greater than its parts
The perceptron algorithm: Basic machine learning
How computers learn to recommend with K-Means

Mitchell
Yolanda Zhou (2)*
Mingshi Yang (2)
Serena Xu (17)
Jeffrey Yuan (17)
Tzer Wong (4)

12 PM

Coffeehouse Lounge

When baking goes wrong: Why hacking works
The traveling salesman problem: Finding optimal solutions using algorithms
How does Spotify know what your next favorite song will be?
How websites protect your password... and how they don't!
Are some infinities bigger than others?
How good is my team? Modeling sports with statistics

Cardinal
Nicholas Janovetz (18)*
Julian Gomez (18)
Erica Santana (18)
Rachel Thornton (18)
Sibo Wang (18)
Austin Wang (18)

12 PM (cont.)

Mezzanine Lounge

Predicting trajectories of launched projectiles
How to make electricity from thin air
How to convince computers to cooperate
Math with switches!
Talking with machines: The science of natural language processing

PDR 1

Reinventing Shazam: Exploring concepts in digital music processing
Secret lover messages: "Spicy" Diffie-Hellman key exchange
Spice up mediocre shots with special effects
Teach a computer to recognize objects by tuning an electronic brain like a guitar
How the U.S. government secures classified information (AES)

PDR 2

The friendship paradox: Why are all your friends more popular than you?
State machines: Creating an effective model for your next big idea
Monte Carlo simulations: Guessing Pi without hard math
Solving big problems, the easy, automated way
Storing data in magnets: How a hard drive works

PDR 4

The envelope paradox: Making reasonable guesses about expected outcomes
Quantum qubit search
How a pigeon beat the internet: Big-O
Are you playing a fair game?
The unfairness of elections

Twenty Chimneys

How to find the perfect apartment: When to stop looking
How to efficiently group your huge bag of M&Ms by color
Alice's "Drink Me": The recipe to make things smaller
Sharing nests
Not your mother's secret code
Half the power, all the time: How to build efficient electronics

West Lounge

How to prove that you know something, without revealing it
When computers agree to disagree
How to take down a website
Artificial computation for real intelligence
Q-learning: How a game of pong could lead to the robot apocalypse

Jorg

Victor Fink (10)*
Romeo Flores (10)
Reynaldo Garza (10)
Druck Green (23)
Rex Stockham (23)

Drew

Zachary Zumbo (10)*
Christie Hong (10)
Erica Weng (10)
Christian Henn (10)
Paul Herold (10)

Remi

Su Yang ((14)
Alan Cheng (14)*
Laura Pang (14)
Isaac Wolverson (18)
Henry Wu (18)

Long

Jamie Bloxham (21)*
John Peurifoy (20)
Chase Warren (20)
Lantian Chen (21)
Arkadiy Frasinich (21))

Shaiyan

Sean Fraser (20)*
Xinyi Chen (20)
Benjamin Gruber (20)
Lila Jansen (20)
Megan Prakash (20)
Adam Rodriguez (20)

Jason

Qingshu Han (6)*
Patrick Wahl (6)
Diana Molodan (4)
Maya Kaul (6)
Kevin Zhang (6)

1 PM

Coffeehouse Lounge

Deep learning for babies and autonomous vehicles
How to iron your photos
Piecing your photo together
Going with the flow: How to get the most out of a network
Domain Name Service: Internet's phonebook
How to efficiently search your backpack for homework

Mezzanine Lounge

Computers are like cookies
How to create breathtaking, realistic scenes in a computer using ray tracing
One wall to knock them all down: Math proofs with the "domino effect"
Looking inside your body with magnets
How to create panoramic photographs

PDR 1

Using radar to prevent plane crashes
How do 3D glasses really work?
Disconnecting a system using the least amount of cuts
How finite-state machines can help protect the state of humanity
Cookies and cancer: Methods and applications of single-cell RNA sequencing

PDR 2

Digital magic: How to conceal secret images using steganography
The Monty Hall problem: Making sense of counter-intuitive probability
How can you use induction to wipe out an island with blue-eyed people?
How to find the optimal spouse
Merge sort: How to efficiently sort
Cake cutting can be a piece of cake

Twenty Chimneys

Teaching machines to read
What if hard problems were easy? Understanding the question of P=NP
How to train a pet robot
How GPS works
How to find your soulmate with 37% success

Jason

Skyler Kaufman (3)*
Budmonde Duinkharjav (3)
Chloe Garden (3)
Sophia Kwon (3)
Hyeyoung Shin (3)
David Rosales (4)

Mitchell

Quinn Magendanz (3)*
Danny Tang (3)
Alejandro Velez (3)
Nicholas Waltman (5)
Hiram Moncivais (4)

Remi

Hojin Jeon (23)*
Nestor Franco (23)
Vincent Vostatek (23)
Adis Ojeda (23)
Baris Ekim (14))

Luis

William Mitchell (13)*
Priscilla Wong (14)
Eric Jiang (14)
Stella Yang (13)
Rachel Lin (13)
Ricardo Albino Camacho (12)

Shaiyan

Francis Soucy (22)*
Jasmine McGhee (22)
Apurva Shrivastava (22)
Amanda Ke (22)
Santiago Ospina (21)