

CS1 Seminar/Discussion

Seminar: Fridays 9:00 to 9:50

- **Objectives**
 - *Introduce Freshman to CS*
 - *Expose on CS courses*
 - *New topic every week*
 - *Data mining, Vision & Graphics, etc.*
 - *Lectures will vary*
 - *Try to align perspectives*
 - *Load for class is light*
 - *TA will go over details and Quiz every wed.*
 - *Relatively light*
 - *Do it as an opportunity to have fun*

September 28, 2018: When Computer Science Meets Social Science—Yihzou Sun

- Data mining is a broad field
 - Can apply to a broad range of topics
- Specific type of data-Social Science
 - Ex:
 - Trump's stance in issue of military service
 - Bill will be passed in Congress?
 - Avg. ideology of Twitter users in each state?
 - Inference on a user's stance based on comment
- Twitter has a public accessible API
 - Can provide some constraints
 - Filter by region, words
- News comments
 - Comments on the article
 - Gives you the chance to filter
- Online forums
 - Easy way to see opinion on people interested in same topic
- Different data
 - Suppose we have data from voting record of congressmen
 - How can we re identify ideology of each congressman
 - Data is preprocessed into some chart, table, diagram, graph
 - Those values become the Values on those axes
 - Text is a model of data
 - Consider each word in a text can be a node
 - Frequency of words can denote weight of an edge
- Input Legislative Network
- Outputs
 - x_u : Ideal points for politician u
 - a_d : Ideal points for bill d
- Data is then analyzed
 - Reevaluate our method via prediction on a new survey, bill, etc.
- Technique is a metaorganization
 - Learn to handle network data
 - Lots of formulas
- Higher values in the x axis indicates a more extremist value
- Scatter plots can show difference between two parties
- Research cannot be done on the topic of fun?
- Twitter can reveal ideology and who they support more
- Tweets, retweets, follow, and mentions can have a relation weight
 - Sentiment analysis can affect relationship weights on mentions
- Data collection
 - Seed users collection

- Manually collect 487 politicians from Twitter
 - This is a small data set
- Expand from seeds
 - 5000 Followers and followees for each seed
- Filtering
 - User Set I (More political related): Users with more than 20 followers/followees in the seed set
 - User Set II (Less Political Related): Users with 3-5 followers or followees in the seed set, random sample 10,000
- Ranking gives you numbers to show whether they are further left or further right
 - Data is compared with the grand truth
- Ideology can be represented in a map as well
 - This can be seen in a political stance map of the US
- Another example of a case study is Ideology vs Twitter Screen Time
- Co-Evolution model for social network evolving and opinion migration
 - Can we use data mining to change people's opinion
 - People's opinions always change
 - The whole thing is a dynamic system
 - Gravity based matrix is being used
 - Why will people's opinions change
 - Friends
 - Also other animals
 - Position moves in similar directions
 - If two people show similar ideologies, they will be friends
 - Ideology will change and continue to shift
 - Using this model, we can make an animation to show this
 - We need to make more friends to get differing signals
 - We need strong opinion leaders

October 5, 2018: Network Algorithmics: Making the Internet Faster—George Vargsche

- Algorithms to speed abstractions in all systems
- Abstractions-representing essential features without including the background details or explanations
 - Ex 1: Virtual memory
 - Abs: Illusion of infinite memories
 - Algorithmics: Paging alg
 - Relational Databases
 - Abs: Operations on Logical tables
 - Algo:
- Algorithmics is to bring the abstractions back up to speed
- Algorithmics started due to the web exploding and the TCP was slow
- Algorithmics is a mixture of algorithmic and system thinking
- Basics in CS are done
 - What is important is to join two fields
- Confluence-meeting two rivers
 - In CS, it is interdisciplinary
 - In CS, there is an additional inflection point and Milieu change
 - Something has happened in the world to make this required (social)
 - Milieu change-What is changing so that we have to rethink our ideas (technical)
 - Result is completely new ideas
 - Psych and photo made impressions
 - Algorithms and probability made randomized algorithms
 - Look at prime number algorithms (Miller-Rabin)
 - Why?
 - There are a lot of fads
 - Separate trends from fads
 - Provide research
 - All interdisciplinary work != confluence

- Algorithmics via Confluence
 - Algorithmics is the idea that we want to make things faster
 - RDMA
 - Streams-Network and architecture
 - Inflection point-Cheap Clusters
 - Mieleu change-Machine bus to network bus
 - Outcome-Algorithmics
 - All the computers shared a cloud of disks, and each memory had to go thru the processor first
 - CPU bottlenecked the process
 - DMA-If you want to read a huge file in memory, you bypass the CPU and traversed thru the bus
 - RDMA is extended across the network
- RDMA to fast servers
- Routers are devices in the middle of the network that connects the networks together
 - Routers route the packets that they receive from one place to another
 - We do lookups based on prefixes
 - The world is summarized by prefixes
 - Prefixes are not the same length
 - You look the closest similar number
 - We can sometimes take the longest path
 - As we get more and more specific, we look at much more different components
 - The main issue is that if it is full addresses, we could use a hash table
 - We start with IP v 6 traffic
 - We want to have Msec to usec
 - The idea was that we would put all prefixes in the hash table
 - Stop do binary search, we start in the middle
 - Add markers in the middle
- Create yourself
 - Think a little deeper
 - Embrace collisions
 - Network algorithms is not the same as algorithms

October 12, 2018—Career CS Theory—

- Algorithms and Cryptography
- Career
 - PhD is dependent on how independent you would want to be
 - If you just wanna code, stop at bachelor's
 - More independence is at Master's
 - Most independent is PhD
 - Loss is being poor, but it is an investment
 - Work and then back to graduate school
 - Rare, because we have a high salary and we start to lose the ability to study
 - Graduate school: Getting into it
 - 4.2 GPA as an undergrad didn't get into MIT
 - 300 to 400 applications that get inputted
 - Going through the deck, prof normally takes people that have papers
 - Who has published paper in the best conference?
 - Papers prove you have the ability to do research
 - Going into industry after undergrad means GPA is important
 - For going into grad school, do research with someone
 - For undergrads, take high level courses to know what you are interested in
 - Talk to professors to get research opportunities
 - This is definitely for PhD
 - For Master's
 - Acceptance rate is less competitive
 - Research is often parallel in this field
 - More about making money

- Cutoff point is your GPA
- For the CS degrees, you can open up a startup in LA or Silicon Valley
 - Investors will want to know that you have a user base already and an idea that is already copyrighted
 - Never ask your friends and family for an investment
- PhD
 - Most top schools will only accept 20 to 25 applicants
 - University makes money from research
 - 56% of grants gets given to university
 - Most prof do research and only teach one class in the research field
 - Main jobs of the professor is to do research
 - Teaching is only a side job for most professors
 - Research is the decision point of the PhD
- Out of 2000 PhD
 - 50 will go into teaching
 - Others will do research labs
- Getting into faculty positions
 - You have to be really creative in 4 or 5 research papers
 - This will give you a chance to interview
 - Teaching positions
 - Don't do community college or you teach more
 - Do some research institution as you teach less and research more
- Some people don't make some PhD
- Some professors don't get tenure in the end
 - This is a very limited field
- Not all professors have the base salary
 - In CA, there is a public listing of everyone's salary
- Professors in STEM gain more than literature, history, and art
- Sometimes universities will incentivize you to get more money for them
- In private university, kids get free education if parent is professor
- In public university, you get an extra benefits in retirement
- In industry, CEOs and Research heads will define research that you are allowed to do
- Most universities and companies will only hire PhDs for their name
- Story:
 - A king has a huge cage with a lion in it
 - People would walk in and see and think the king is amazing
 - Some mathematician was hired for name, not actual use
- How much freedom you get depends on the research lab you get into
 - Independent but not free sometimes
- Don't switch from Industry to academia
 - Industry asks for you to work on problems relevant to the company
 - Colleges will ask you to publish a paper every year
 - If you stop publishing papers each year, people will think you lose ability
 - You can get fired if you lose ability to research papers
- There are not too many benefits for industry
 - The only skills you gain are knowledge, research, and problem solving
 - People will ask you about your research in interviews
- Cryptography
 - CS theory is based on what even computers cannot solve
 - Deals with things like communication complexity
 - Work product is some theorems and proofs
 - If you write software code, you cannot know what is the problem in the code for sure
 - CS Theory is very clear on whether or not some problem is solved
 - Problems are easy to verify, hard to solve
 - Algorithms are for solving various problems faster
 - For every problem, there is no pore of knowledge

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- It is very rigorous science and mathematics
- Cryptography is a question based on secret communication
 - It is about trying to keep your communication as quiet as possible
- If there exists some person that got through your security solution, then there is an error
 - Factoring math problem was a famous solution to this because the problem is one of the unsolvable mathematics problems
- Zero knowledge proof
 - Someone proves something, but will not release the proof but convince someone of the proof being true
 - Just use examples

October 19, 2018—Teaching Computers to Understand Human Languages (Natural Language Processing)—Kai-Wei Chang

- Look at the nearest pronoun to label the subject
- Co-reference resolution
 - All phrases that refer to the same entity are marked
- Semantical labelling
 - Labeling subject, object, punctuation
 - Written in logic using <Object>/<Classification>
- Information Extraction
 - Unstructured text to database entries
- Applications of Machine language translations can be seen in Facebook or Google Translate
- Can be used for data mining
- 3 NLP applications
- NLP can be very wrong still
 - With ambiguity
 - Computer doesn't understand puns
- Word embedding can still be very sexist
- Research is to remove the bias
- Language is not static
- Learn some input to output space is machine learning

October 26, 2018—Artificial Intelligence—Andan Darwiche

- Broad goals of AI are shared with other disciplines
 - Including philosophy, cognitive science, psychology, and neuroscience
- The Turing test
 - Proposed by Turing as an operational test of intelligence
 - Fool a human interrogator into believing the agent is a human
 - NLP
 - Knowledge Rep
 - Automated reasoning
 - ML
 - The Nobel award for CS
 - Avoid interaction between interrogator and agent, excluding need for
 - Computer Vision
 - Robotics
- We represent knowledge through facts and beliefs
 - What knowledge is relevant?
 - How do we acquire knowledge?
 - From experts
 - By conversion from other forms of knowledge
 - By learning from experience
- Reasoning is deduction, belief revision, causality
 - Deduction is what is implied by a knowledge base
 - Belief revision are the beliefs we have to give up in the case of a contradiction
 - Causality is what the cause of an event is

- Applications of KR&R (Knowledge Representation & Reasoning)
 - Medical Diagnosis
 - Credit Card Fraud
 - Theorem Proving
 - Formal Verification
 - Cognitive Tasks
- Deep Learning
 - Functions have many inputs and many outputs, not one to one like normal programming

November 2, 2018—Overview of Big Data

- Big data is going from point 1 to point 2
- Big data is data over a course of time
 - Ability to collect data will only increase
 - Ability to analyze will only improve
- Privacy will go away with the advancements of big data
- You can constantly broadcast traffic data with big data
- Collect data and analyze
- Data mining difference?
 - Big data contains the field of data mining
- Data mining is to find patterns in data
 - Data mining is extracting rules
- Machine learning is to try to use data to make predictions
- Correlation are values that track each other
- Causation is one value causing another
- Correlation does not imply causation, but there are variables that exist that contribute to the fact overall
- ML uses regression to fit points to try and show data

November 9, 2018—The Future of Robotic Space Exploration

- We don't need to find water to say there is life
- There was probably water before our solar system formed
- We can say liquid methane can support life
- JPL is part of CalTech
- AstroLabs - Leon Alkalai is the founder
- November 26th is our InSight Mars Landing
 - Mission is to find the interior structure of Mars
- Seismometer-Stethoscope for mars
 - Checks For Quakes
- Then a thermoconducting-tells how scope is radiating energy to the surface
- JPL is visiting all over the place
 - Just asking why that planet is that way
- We do so by comparison between our solar system to the outside
- How is our solar system so conducive to life?
- We study Earth
 - How did life originate or get imported to Earth?
 - How did life originate?
- Pillars of Creation
 - We see outside of our solar system these clouds combusting into another star
- The solar system could form by a sun forming a gravity field and forming rings
- Kepler found planets in the thousands and suns as well
- JPL want to image the planets in much better image
- Star shade-deployable structures that would fit onto a table, but it could deploy to the size of a football field and block the light from the sun so the sensor in the camera can see the planets
- The planet shines reflected light
- We can detect whether or not the planet has different weather patterns, chemicals, etc.
 - Limited however, when we take it from the Earth, we get a single pixels worth of an image
- Solar exoskeletons: We take energy from the sun and use it to produce a multi-spectral image

- Solar gravity lens-we take energy from the sun and use it to produce a multi pixel image
- We have people looking at dark energy, dark matter
 - Understanding how the universe is and how it began
- We have the launch of a solar probe
 - How can we get closer and closer to the sun?
 - So we can get FASTER?
- Cassini- Mission at Saturn
 - Nuclear Powered
 - Enceladus is Titan's extra rings, has geysers
- All Europa, Enceladus, and Europa are inhabitable because of Methane lakes
- We have a mission to get more Mars Rover landings
- We have had the most successful Mars Missions
- We will have another rover in 2020 that also uses skycrane
 - First was Curiosity
- 2020 will be returning samples of Mars to Earth
- We test by trying our best to recreate what environment we will see on Mars on Earth
 - "Test as you fly"
- SpaceX, BlueOrigins are supported by both NASA and JPL
- JPL is driven by space science
- Commercial is driven by revenue
- Future Enabling Capabilities in Space
 - Fundamentals of Small Spacecraft
 - Small satellites are being developed everywhere
 - U is a standard building block of satellites
- In the last couple of years, there are multiple functions of small sats
- There can be a small antenna that is released and can download much data
- There will be the first two satellites at Mars in two weeks
- Temporal imaging is an advantage of cube sats
- The Mars Heli will happen when 2020 mars lands

November 16, 2018—Computational Biology

- Computational Biology
 - Genomics
 - Fundamental questions about disease and evolution
 - Massive data from new technologies
 - There is a bottleneck from the computation
 - Computation is key to making sense of genomic data
- The grand idea behind it is personalized medicine
 - We can go to the doctor and get some personal chemicals that are specifically developed for us
 - Example for today is warfarin
- Warfarin used to be for rat poison
 - Optimal dose for treatment varies
 - There is a website for optimal dosage
- We currently have personal genomics that currently exists
- The human genome project is DNA
- We can currently look at genomes and compare it to someone that has a disease
 - This is known as association studies
- We have been able to see more than a thousand human genomes
- We have a problem for short read resequencing
 - How do we go from short random substrings and recover the whole string?
- Key idea: resequencing
 - We differ about one in a thousand genomes, but most are identical
 - Check for each position for less than a certain threshold of mismatches
- Most positions in a genome will match poorly
- A substring will match perfectly
- We will create a data structure
 - Create an index

- Create an index
- Chop up genome into substrings
- Record previous data sets that have been previously found
- Other problems can also have insertions and deletions
- Bioinformatics: Answer biological questions using tools from CS, math, and stats
- ML: Learning from data
- Ancestry can be predicted from the genomes that you have
- Local ancestry inference is a research problem
 - The ancestry of admixed individual is from their specific ancestry genomes
 - Ancestry switches are not known
 - Ancestral allele frequencies unknown or poorly estimated
 - Non-independence of SNPs

November 30, 2018—Computer Architecture

- Designing next generation processors
- Making computers move faster
- It has become very difficult to make computers much faster
- What can we do to fix it?
- You can have a computer w/o having an architecture
- Architecture is the glue that binds everything
- To make an architecture, we need:
 - Memory: a place to put values (state, variables, etc.)
 - Instructions: moves from one state to the next
 - Program: set of instructions (let's put it in memory)
 - Execution model: when do we execute each instruction?
- Von Neuman Execution
 - Most common model today
 - Instructions are executed sequentially, defined by a "program counter"
- How does software use the ISA
 - Program goes thru a gcc compiler and a.out(binary then uses obj dump to produce and ISA)
- Hardware uses ISA
 - Steps:
 - Fetch - Grab instruction
 - Decode - Interpret instruction
 - Execute - Perform computation
 - Writeback - Update state
- ISA is how a CPU works basically
- CPUs have been getting harder to improve
- GPPs use parallel computing
- Three reasons CPUs fail

Discussion: Wednesdays 9:00 to 9:50

- Attend lectures on Fridays
- Attend discussions sessions
- Take a quiz during lecture of the week (9 quizzes)
- Write an essay due middle finals weeks (TBA)
- Write 3 peer reviews according to template
- Grading:
 - 60% quizzes (lowest grade dropped)
 - 10% peer reviews
 - 30% essay (final grade dropped)
- Quizzes have 5 multiple choice questions in 10 minutes
- Make a prediction of one new CS related application with high impact to technology
 - Also have to write about two essays that appeal to you the most
- Peer reviews will include scores and comments

October 3, 2018

- Yihzou Sun is working in data mining
- Mining is in regards to large quantities of data
- We have personal info regarding us on social media, online, etc.
- We have large amounts of data and in order to find more about us, we have to use special techniques to find more
- With a large number of gigabits, we can use the programs to run through our data
 - We can find patterns, sift through related key words
- Ideology detection
 - Legislative voting network mining
 - Data mining is about estimating the patterns in order to find out more about the results
 - Heterogeneous types of links
 - User stance predictions via joint modeling of text and social interactions
 - The Co-Evolution Model for Social Network Evolving and Opinion Migration
- Data comes from news comments, online forums, etc.
- These are all different types of data
- We use different techniques for different problems
- We know whether or not a politician will end up voting for a certain bill
 - The results are often binary
- We will normally have a binary model in order to determine data results
- We can define problems through ideal points in the model
- We can determine whether or not a thing will happen using cross validation
- Our predictions should be able to predict whether output is correct or not
- We can select 90% as training and 10% as testing
- In Twitter, we may have relationships in follow, mentions or retweets
 - Retweets are the most influential
- Because links are of different types, we call them heterogeneous
- Maximize the likelihood of observed positive links
- Likelihood is how likely the predicted outcome is to happen
- Probability is estimated outcome
- Likelihood is the outcome's predicted model
- To maximize likelihood, adjust model to fit observed data
- Ranking shows retweets give highest accuracy among all 3 actions
- People with similar ideology tends to link together
- Model the similarity based on data
- Actors are influenced by their neighbors

October 10, 2018

- Algorithms can speed up abstractions in all systems
- We can either connect applications' memories or transfer data to external to increase memory
- Algorithmics started in 1990s due to TCP and IP datagrams being extremely slow
 - 1969 was the birth of the internet
 - 1970 was when the internet started making the internet public to more people
 - TCP/IP was developed at this time
 - 1990s, we have the internet released to the world
 - IPv6 was developed
 - IPv6 has 128 bits
 - 2000s-mobile smartphones were developed at this time
- Algorithmic were techniques to restore the speed of abstractions to that of fiber
- Confluence definition
 - Some main stream is affected by some impacting stream in order to create some new stream
 - Milieu change is some technical change
 - Inflection point is some social phenomenon
- Examples
 - Distributed algorithms
 - Computational networks
 - Cryptography

- Cryptography
- Confluences help us connect new fields to make more powerful findings happen
- Not all interdisciplinary work is confluence
 - All confluence must have some milieu change and an inflection point
- Network algorithmics
 - Set of algorithms to make network devices to work faster
 - Confluence between computer architecture, algorithms and networking
 - Inflected by cheap cluster, explosion of web, and IPv6
 - Prefix lookup is an example
 - Some table will keep some notes of where to send some certain signals
 - Linear search worked by marking prefixes that were the same
 - Binary divides by two and works by bubble sort technically, but in terms of a packet
 - RDMA is an example
 - Servers were getting slow

October 17, 2018

- Theory of Computation
 - A branch of computer science that deals with how efficiently problems can be solved on a model of computation
 - Automata theory and languages
 - Computability theory
 - Computational Complexity theory
 - What are the fundamental capabilities and limitations of computers?
 - How do we design effective and efficient algorithms?
- One problem possible is the solving problem.
 - One through two, how to solve from one through two
 - Solving problems
- CS 180 is about algorithms
- Reduction is a technique to relate computer problems to math problems
 - If we can reduce some problem A to a problem B and B is a polynomial, we can solve A via polynomial methods
- Evaluating Complexity
 - Time complexity
 - How much processing time used?
 - Space/Memory Complexity
 - How much memory is being used here?
- Computability of problems
 - The halting problem is not very computable
 - Alan Turing proved in 1936 that a general algorithm to solve the halting problem for all possible program-input pairs cannot exist
 - We call algorithms some Turing machines
- Turing test-If an artificial intelligence can fool some judge into thinking it is not AI, it passes
- Cryptography
 - Secret key establishment
 - Secure communication
 - How can two machines have the same key to encode or decode a string of alphanumeric
 - Confidentiality and integrity
- Problems 1: Zero knowledge proof
 - Proving you know some secret or many secrets to someone at the other end of communication without revealing it
- Yao's Millionaires' Problem
 - The problem discuss two millionaires without revealing their actual wealth

October 24, 2018

- Teaching Computers to Understand Human Languages
- Remember by logic, the pronoun nearest the proper noun is referenced in that way
- WP-Who what whv

- ... time, what, why
- VBD-Past tense verbs
- NNP-Objective
- Convert a question to logic of Objective/Entity
- Algebra word problems
 - Into real mathematical forms
- Information extraction
- Unstructured text to database entries
 - Text to their tables respectively
 - Based on key words and positioning
- Structured knowledge is represented in a table
- Machine translation is similar to Google Translate
- Sentiment/Opinion Analysis
 - Analyze ideology of posts
- There are still many problems on intent vs impact
- Expectation vs reality
- Machine translation can still get complex things wrong
- Ambiguity is still there with different statements
 - Ambiguity happens when the same word has different meanings
 - Again what you mean vs interpretation
- NLP is also sexist
- Syntactic ambiguity when you don't refer a secondary noun to its owner
 - Ambiguous headlines
- Word sense ambiguity
 - Figure of speech issues
- There is still sexist ambiguity that the computer assumes, meaning that some jobs are directly related to certain genders
 - Phrases, statements, words happen to have this
 - Phrases are still based on statistics
- Pronoun reference ambiguity
 - Who is the pronoun referencing
- Language is compositional
 - One word can have multiple meanings
 - We normally use street smarts to understand
- Language is dynamic
 - It grows, changes, compacts
- Prerequisites
 - Linear Algebra
 - Calculus
 - Probability
 - Algorithms
 - Programming
 - Data Structures

October 31, 2018

- AI - A field of CS concerned with understanding and building agents that can perceive, understand, manipulate, and learn
- AI Goals is to shared with NS, PSYCH, and COGSCI
- Turing test is to test if an AI can fool an interrogator into thinking it is human
 - ChatBox
- We represent knowledge through facts and beliefs
 - Facts are known and certain
 - Beliefs are uncertain
- Reasoning
- Forming Causality
- How can we make sure to have high accuracy and low robustness
- Supervised: Give observations and actions they should lead to

- Supervised: Give observations and actions they should lead to
- Unsupervised: Give observations only (find patterns)
- Reinforcement: Give positive/negative feedback on actions
- Deep Learning - called deep because it has multiple layers and nodes
- We still need to explain many things about AI

November 7, 2018

- Big Data
- We collect data and use it to predict
 - Traffic data
 - Recommender systems
 - Online Advertising
 - Sports
 - Ocean health
- Big data encompasses
 - Basic data manipulation and analysis
 - Data mining
 - Machine Learning
 - Data Visualization
 - Data collection and Preparation
- Data mining is looking for patterns in data
- ML is using data to build models and make predictions
- Data visualization
 - A picture is worth 1000 words
 - Or a trillion data points
- We can get insight between relationships in the data set
- We have data visualization non linearly now and more color coded as well as cleaned up
- Data collection and preparation
 - We want to prepare the data for future analysis
 - Remove suspicious data and fill in missing values
 - Make formats, encoding, and units consistent
 - De-duplicating and matching
- Pitfalls of big data
 - Collect data
 - Do something *correct* with it
- Correlation
 - Values track each other
- Causation
 - Values directly influence one another
- Correlation does not imply causation
 - Correlation can be a result of causation from a different confounding variable
- Underfitting
 - Model for predicting data is too simple
- Overfitting
 - Model for predicting data is too specific
- Regression
 - Fit a line or curve to a set of points
- Data privacy disappears as we proceed with big data
 - You want to collect data covertly

November 14, 2018

- InSight will be the first mission to study the deep interior of Mars
- Learning the history, evolution, and future state of our solar system
- Pillars of creation
- Kepler
 - Satellite that is taking photos of 8 billion year old cluster of stars 13,000 light years from Earth
- Understanding the diversity of planetary systems in our galaxy

- Understand how the universe began and how it is evolving
- Large missions need large resources
- Cassini
 - Exploration project for Saturn
- Huygens is a probe for Saturn's moons
- Study Enceladus
- Mars exploration program
- The future:
 - Hope to have highly intelligent and capable anthropomorphic robots
 - Robotic tech
 - Do many tasks that the human can already do

November 21, 2018

- Computational biology-where we take CS techniques and incorporate it into Biology
 - Specifically genomics
- Data came from new technologies
- Bioinformatics-answer bio questions using CS, stats, and mathematics
- Overall goal is to have some optimal dose for a person based on each patients
- Personal genomics
 - We can match our genomes with the human genome and see the probability of a difference
- GWAS-Association studies
- We have a benefit of dealing with more complicated
- We have machines in order to do short read sequencing
- Resequencing can help recover the original DNA sequence of a person
- 99% of the genomes should match perfectly
 - Resequencing realizes this and allows for tolerance
- Most genomes match poorly with any other position
- Challenges include memory, nonuniform coverage
- Random errors, insertion, and repeat sequences
- Local ancestry inference
 - Uses Machine learning

December 5, 2018

- We have fetch, decode, execute, and writeback
- Decode and execute, memory is not used
- Diana
- Proteus
- Stripes
- ISAAC
- EIE
- FPGA
- Origami
- GPP are stagnating
- ML processors are thriving
-