Artificial Intelligence (BITE308L)

State of the Art

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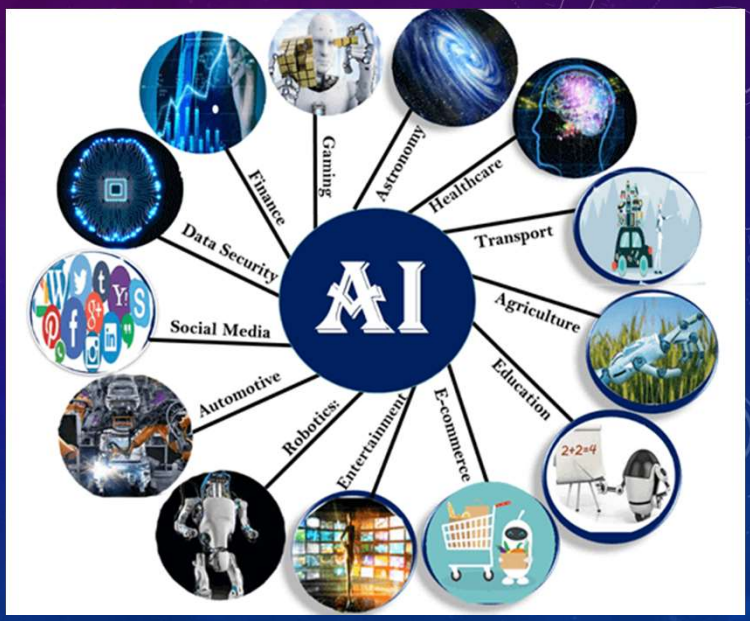
AI - APPLICATIONS

What can AI do today?

- A concise answer is difficult
- There are so many activities in so many subfields



AI - APPLICATIONS

- Astronomy
- Healthcare
- Gaming
- Finance
- Data Security
- Social Media
- Travel & Transport
- Automotive Industry
- Robotics
- Entertainment
- Agriculture
- E-commerce
- education

AI - APPLICATIONS

- **Robotic vehicles**
- **Speech recognition**
- **Autonomous planning and scheduling**
- **Game playing**
- **Spam fighting**
- **Logistics planning**
- **Robotics**
- **Machine Translation**:

- These are just a few examples of AI systems that exist today
- Not magic or science fiction
  - But rather science, engineering, and mathematics,
  - To which this course provides an introduction

ASTRONOMY

- AI - Very useful to solve complex universe problems
- AI technology - Helpful for understanding the universe such as
  - How it works, Origin, etc.

AI's appetite for data

- AI Vs ML
  - AI: computational behavior that mimics the way humans think and do
  - ML: a family of technologies that learn to make predictions/ decisions based on vast quantities of historical data
  - Eg: Facial recognition Spam filter Digital assistants (Siri or Alexa)

ASTRONOMY

AI's appetite for data

- Many ML technologies - now being used by astronomers to investigate the mysteries of space and time
  - Because, if there's one thing
    - Astronomers have too much of
    - ML models can't get enough of
  - it's data

HEALTHCARE

In the last (5-10) years:

- AI becoming more advantageous for the healthcare industry and going to have a significant impact on this industry
- Healthcare Industries apply AI to make a better and faster diagnosis than humans
  - AI can help doctors with diagnoses
  - AI can inform when patients are worsening
    - So that medical help can reach to the patient before hospitalization

GAMING

- AI machines can play strategic games like ***chess***,
  - Where machine needs to think of a large number of possible places

IBM's DEEP BLUE (1st computer program to defeat world champion in a chess match)

- When it *bested Garry Kasparov* by a score of 3.5 to 2.5 in an exhibition match (Goodman and Keene, 1997)
  - Kasparov said that he felt a ***new kind of intelligence*** across the board from him
  - *Newsweek* magazine described the match as ***The brain's last stand***
  - The value of IBM's stock increased by $18 billion
- Human champions studied Kasparov's loss and were able to draw a few matches in subsequent years,
  - But, the most recent human-computer matches have been won convincingly by the computer

FINANCE

- AI & finance industries are the best matches for each other
- The finance industry is implementing
  - Automation
  - Chatbot
  - Adaptive intelligence
  - Algorithm trading
  - & Machine learning
- Into financial processes

DATA SECURITY

Data security:

- Crucial for every company
- Cyber-attacks are growing very rapidly in the digital world

- AI can be used to make your data more safe and secure
  - Eg: ***AEG bot***, ***AI2 Platform***
  - Used to determine software bug and cyber-attacks in a better way

SOCIAL MEDIA

Social Media sites:

- Eg: ***Facebook***, ***Twitter***, and ***Snapchat***
- Contain billions of user profiles
- So,need to be stored and managed in a very efficient way

AI

- Can organize and manage massive amounts of data
- Can analyze lots of data to identify
  - Latest trends
  - Hashtag &
  - Requirement of different users

SPAM FIGHTING

ML algorithms to fight spam:

- Learning algorithms (each day) classify over a billion messages as spam
- Save the recipient from having to waste time deleting
  - What, for many users, could comprise 80% or 90% of all messages
  - If not classified away by algorithms deploys
- Because the spammers are continually updating their tactics
  - It is difficult for a static programmed approach to keep up

❖Learning algorithms work best (Sahami *et al.*, 1998; Goodman and Heckerman, 2004)

TRAVEL & TRANSPORT

AI - Becoming highly demanding for travel industries

- AI: capable of doing various travel related works such as
  - Making travel arrangement
  - Suggesting the hotels, flights, and best routes to customers
- ***AI-powered chatbots***
  - Being used by travel industries
  - Can make human-like interaction with customers for better and fast response

AUTOMOTIVE INDUSTRY

AI:

- Being used by Automotive industries to provide virtual assistant to their user for better performance

- ***TeslaBot*** (an intelligent virtual assistant) introduced by Tesla
- Various Industries are currently working for developing self-driven cars which can make your journey more safe and secure

ROBOTIC VEHICLES

STANLEY (Driverless robotic car)

- Sped through the rough terrain of the mojave dessert at 22 mph
- Finishing the 132-mile course first to win the 2005 DARPA grand challenge

➢ A Volkswagen Touareg outfitted with

- Cameras
- Radar
- laser rangefinders to sense the environment and
- onboard software to command the steering, braking, and acceleration (Thrun, 2006)

CMU's BOSS

- Won the Urban Challenge the following year
  - Safely driving in traffic through the streets of a closed air force base
  - Obeying traffic rules
  - Avoiding pedestrians and other vehicles

ROBOTICS

AI having remarkable role in Robotics

- General robots (usually): Programmed such that they can perform some repetitive task
- But (with AI), intelligent robots can be created
  - These robots can perform tasks with their own experiences without pre-programmed
- Humanoid Robots are best examples for AI in robotics
- ***Erica and Sophia*** (Humanoid robot)
  - Recently developed
  - Can talk and behave like humans

- ***Roomba robotic vacuum cleaners***
  - Over two million in number sold for home use
- ***PackBot (rugged)***
  - Deployed by the company to Iraq and Afghanistan
  - Where, it is used *to handle hazardous materials*, *clear explosives*, and *identify the location of snipers*

ENTERTAINMENT

Entertainment services (daily life) based on AI:

- *Netflix* or *Amazon*
- With the help of ML/AI algorithms, these services show the recommendations for programs or shows

AGRICULTURE

AI in agriculture :

- Very helpful for farmers
- Agriculture is an area which requires various resources
  - Labor
  - money time
- for best result

- Nowadays
  - agriculture is becoming digital & AI is emerging in this field
- Agriculture is applying AI as
  - as *Agriculture robotics*
  - for *Solid and crop monitoring*
  - for *Predictive analysis*

E-COMMERCE

AI provides competitive edge to E-Commerce

- AI becoming more demanding in the e-commerce business
- AI is helping shoppers
  - to discover associated products
  - with recommended size, color, or even brand

EDUCATION

AI in Education

- AI can automate grading so that the tutor can have more time to teach
- AI chatbot can communicate with students as a teaching assistant
- AI in the future can be work as a personal virtual tutor for students
  - Which will be accessible easily at any time and any place

SPEECH RECOGNITION

Example scenario:

- A traveler calling United Airlines to book a flight can have the entire conversation guided by an automated speech recognition and dialog management system

AUTONOMOUS PLANNING & SCHEDULING

NASA's Remote Agent program (Jonsson *et al.*, 2000)

- 1st on-board autonomous planning program to control the scheduling of operations for a spacecraft [A hundred million miles from Earth]
- Generated plans from high-level goals specified from the ground & monitored the execution of those plans
  - Detecting
  - Diagnosing
  - And Recovering from problems as they occurred

MAPGEN (Al-Chang *et al.*, 2004)

- Successor program plans daily operations for NASA's Mars Exploration Rovers

MEXAR2 (Cesta *et al.*, 2007)

- Did mission planning (both logistics and science planning)
- For the European Space Agency's Mars Express mission in 2008

LOGISTICS PLANNING

DART (Cross and Walker, 1994)

- Dynamic Analysis and Replanning Tool
- Deployed by U.S. forces during the Persian Gulf crisis of 1991
- To do automated logistics planning and scheduling for transportation
- This involved up to 50,000 vehicles, cargo, and people at a time, and had to account for
  - *Starting points, Destinations, routes, and Conflict resolution* among all parameters
- AI planning techniques generated in hours a plan
  - that would have taken weeks with older methods
- The **Defense Advanced Research Project Agency** (DARPA) stated that
  - This single application more than paid back DARPA's 30-year investment in AI

MACHINE TRANSLATION

DART (Cross and Walker, 1994)

- A computer program automatically translates from Arabic to English, allowing an English speaker to see the headline "Ardogan Confirms That Turkey Would Not Accept Any Pressure, Urging Them to Recognize Cyprus."
- The program uses a statistical model built from examples of Arabic-to-English translations and from examples of English text totaling two trillion words (Brants *et al.*, 2007)
- None of the computer scientists on the team speak Arabic, but they do understand statistics and machine learning algorithms.