The City College of New York

CSC 36000:
Modern Distributed Computing *NextGen with AI Agents*

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Next Gen 6G/7G Networks with AI Agents

- Current 5G Networks have bandwidth, cost and reliability challenges
- 5G Networks have not been deployed extensively along US yet
- This gives us an opportunity to look beyond to 6G/7G Networks
    - Integration with AI Agents vertical comes there
- Salient point of Next Gen Networks
    - Dynamic Adaptability of Bandwidth intelligently based on Demand
    - Expanding Elastic Optical Networks to Usage in the Real World
    - Tackling transmission of large dimensions of data, guiding the AI Agents
- It brings us to a question on Distributed Processing of Data
    - How do we efficiently transfer compressed data?
    - How can we make the representations efficient?

Data Science

If the only tool you have is a relational database, everything looks like a table.

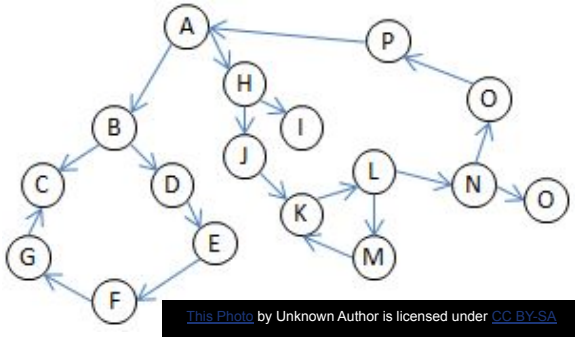
- Data management is important with big data having different modalities like texts, images, videos
- **Relational Databases** are used prevalently to store data in tables with many attributes
- Data Analysis is critical to detect patterns that are useful to AI

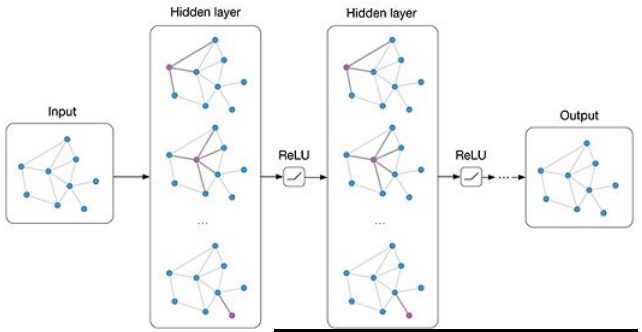
Example: Graph based Data in Social Media

- A graph is denoted as G(V,E) where V is the set of vertices and E is the set of edges connecting vertices in V.

- Social Networks involve users interactively engaging with other users as nodes and their interactions are edges.

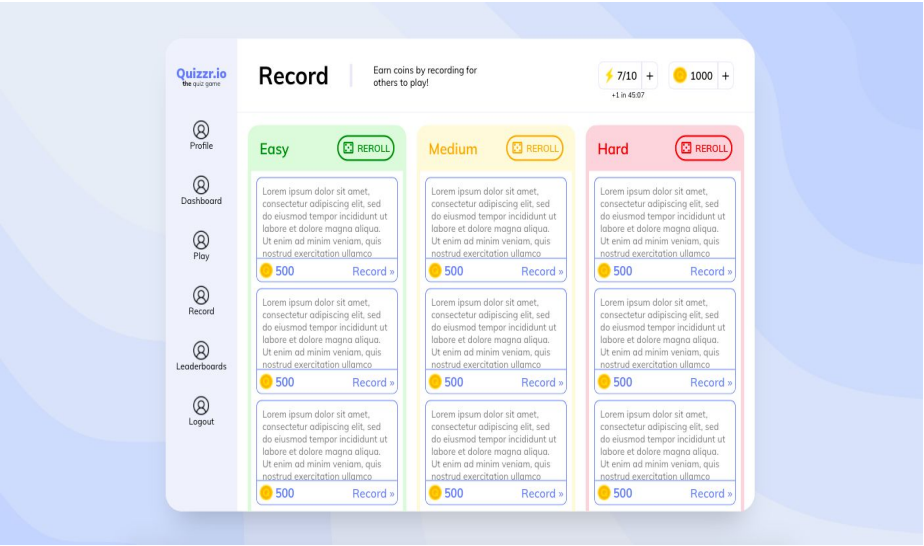
- Learning paradigm also changes with graph based learning in many situations





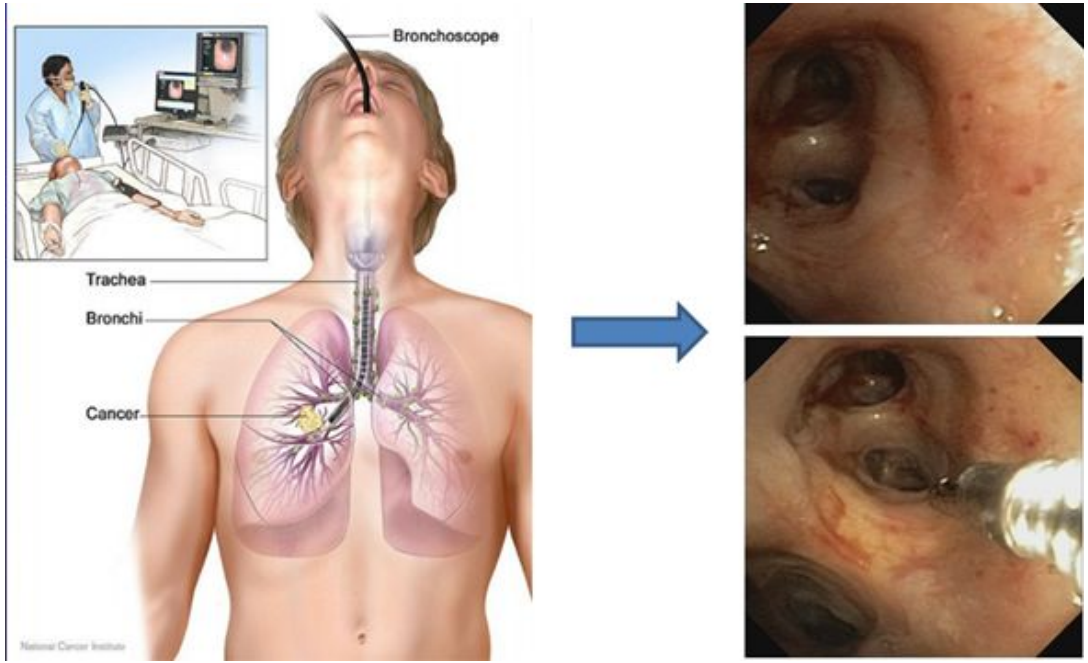
Src: Applications of GNN's (click on image)

Human Computer Interaction



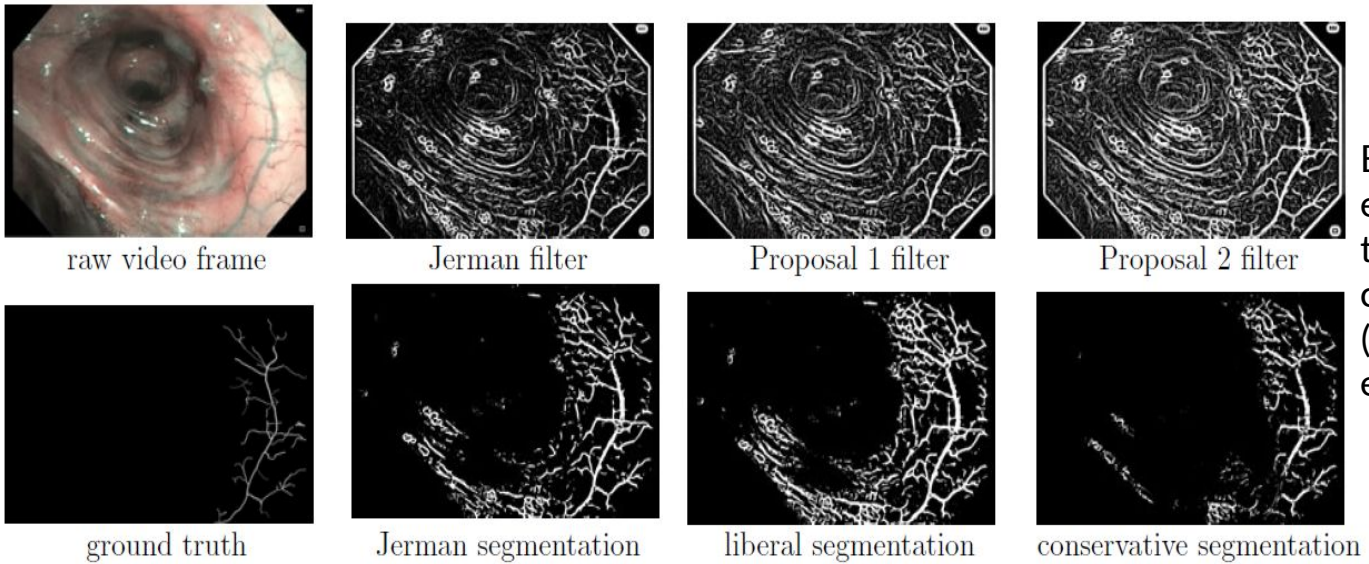
- Website interfaces are developed for user interaction, recommendations with AI & Data Collection

Medical Imaging & Computer Vision



- Endoscopy: Visualization of airway
- Useful for early lung cancer detection and treatment

Medical Imaging & Computer Vision



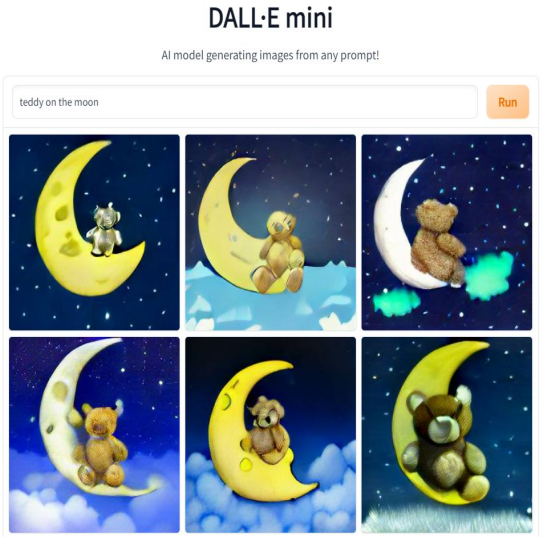
Blood vessel extraction from the airways of a cancer patient (Bandyopadhyay, et al, 2020)

Natural Language Processing

1. Machine Translation - Google Translate/Siri
    a. Multilinguality; Low Resource Languages
2. Question Answering - IBM Watson
3. Summarization
4. Natural Language Generation
5. Fairness of NLP Systems

Multimodal Learning

- Learning from text, images, audios, videos (any mode of information)
- Prominent models like GPT, DALL-E (by OpenAI) https://huggingface.co/spaces/dalle-mini/dalle-mini
- Use Hugging Face pretrained models which are open -access



Multi-Agent Autonomous Orchestration of Global Supply Chains

AI Residency at Google X in Summer 2023
(Open Source Research) Under Submission with Open Source Data

Multi-agent Decision Making in Global Supply Chains

- Global supply chains involving multiple agents enable good movements worth trillions of $s
- There are agents sailing ships carrying good from manufacturing zones to consumer markets
- Then agents drive vehicles or fly from the ports to warehouses to shops or last-mile deliveries
- Agents can also fly goods to remote locations or over difficult terrain
- It is vital to be resilient as seen during the COVID-19 pandemic which shut down supply chains globally

Questions?