

CSCE 580: Introduction to AI *CSCE 581: Trusted AI*

Lecture 19: Machine Learning – NN, DL

PROF. BIPLAV SRIVASTAVA, AI INSTITUTE

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Carolinian Creed: “I will practice personal and academic integrity.”

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Organization of Lecture 19

- Introduction Segment
 - Recap of Lecture 16
- Main Segment
 - Neural Networks
 - Deep Learning
 - Trust Issues
- Concluding Segment
 - Course Project Discussion
 - About Next Lecture – Lecture 20
 - Ask me anything

Introduction Section

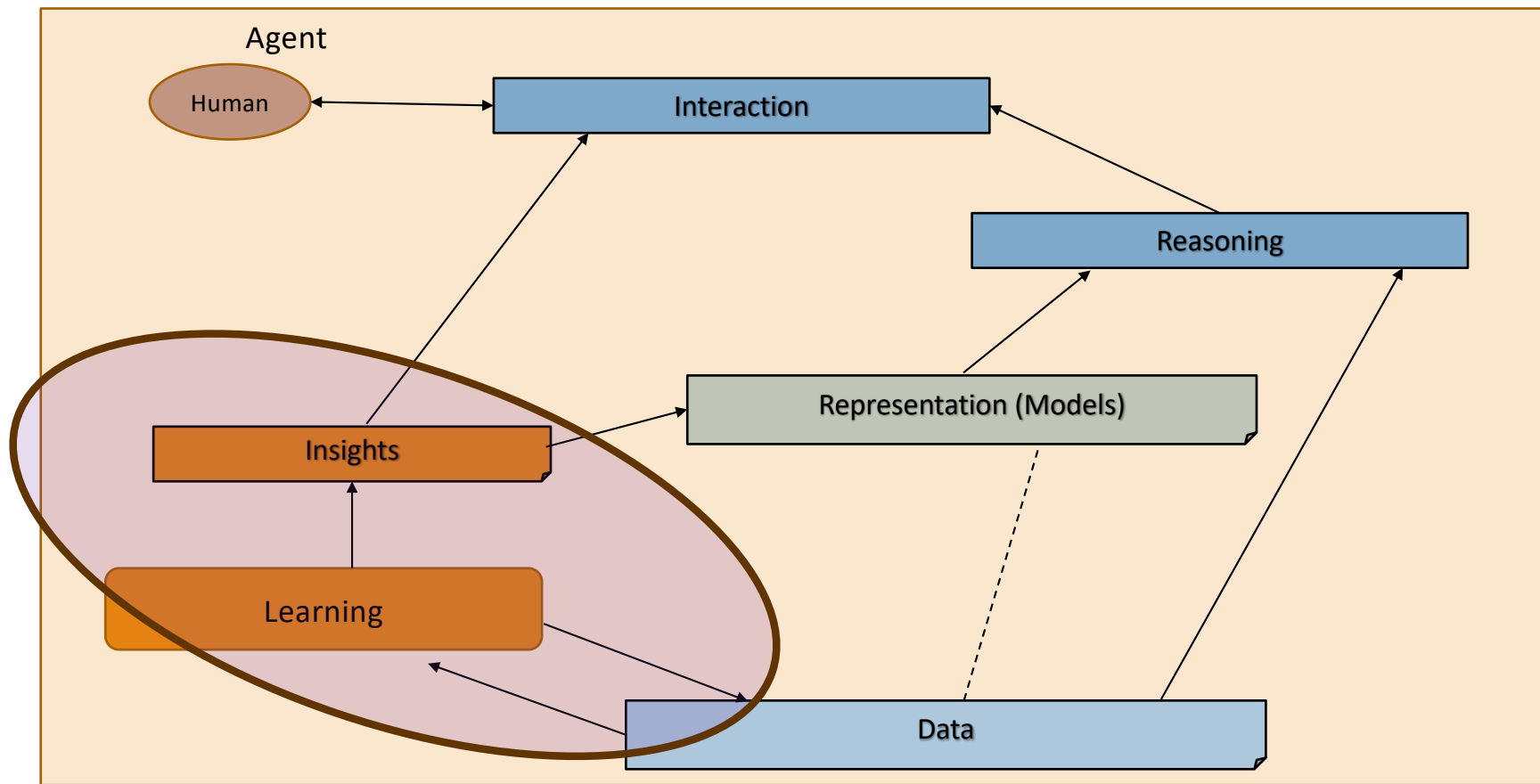
Recap of Lecture 18

- Topic discussed
 - Trust/ Explanations, LIME - Recap
 - Unsupervised ML Algorithms

Intelligent Agent Model



Relationship Between Main AI Topics



Where We Are in the Course

CSCE 580/ 581 – In This Course

- Week 1: Introduction, Aim: Chatbot / Intelligence Agent
- Weeks 2-3: Data: Formats, Representation and the Trust Problem
- Week 4-5: Search, Heuristics - Decision Making
- Week 6: Constraints, Optimization – Decision Making
- Week 7: Classical Machine Learning – Decision Making, Explanation
- Week 8: Machine Learning - Classification
- Week 9: Machine Learning - Classification – Trust Issues and Mitigation Methods
- Topic 10: Learning neural network, deep learning, Adversarial attacks
- Week 11: Large Language Models – Representation, Issues
- Topic 12: Markov Decision Processes, Hidden Markov models - Decision making
- Topic 13: Planning, Reinforcement Learning – Sequential decision making
- Week 14: AI for Real World: Tools, Emerging Standards and Laws; Safe AI/ Chatbots

Main Section

Credit: Retrieved from internet

Machine Learning – Insights from Data

- Descriptive analysis
 - Describe a past phenomenon
 - **Methods:** classification (feedback from label), clustering, dimensionality reduction, anomaly detection, neural methods, reinforcement learning (feedback from hint/ reward)
- Predictive analysis
 - Predict about a new situation
 - **Methods:** time-series, neural networks
- Prescriptive analysis
 - What an agent should do
 - **Methods:** simulation, reinforcement learning, reasoning
- New areas
 - Counterfactual analysis
 - Causal Inferencing
 - Scenario planning

Course Project

Project Discussion: What Problem Fascinates You ?

- Data
 - Water
 - Finance
 - ...
- Analytics
 - Search, Optimization, Learning, Planning, ...
- Application
 - Building chatbot
- Users
 - Diverse demographics
 - Diverse abilities
 - Multiple human languages

Project execution in sprints

- Sprint 1: (Sep 12 – Oct 5)
 - **Solving**: Choose a decision problem, identify data, work on solution methods
 - **Human interaction**: Develop a basic chatbot (no AI), no problem focus
- Sprint 2: (Oct 10 – Nov 9)
 - **Solving**: Evaluate your solution on problem
 - **Human interaction**: Integrated your choice of chatbot (rule-based or learning-based) and methods
- Sprint 3: (Nov 14 – 30)
 - **Evaluation**: Comparison of your solver chatbot with an LLM-based alternative, like ChatGPT

Project Discussion: Dates and Deliverables

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- Oct 12, 2023
 - Project checkpoint
 - In-class presentation
- Nov 30, 2023
 - Project report due
- Dec 5 / 7, 2023
 - In-class presentation

Skeleton: A Basic Chatbot

- Run in an infinite loop until the user wants to quit
- Handle any user response
 - User can quit by typing “Quit” or “quit” or just “q”
 - User can enter any other text and the program has to handle it. The program should write back what the user entered and say – “I do not know this information”.
- Handle known user query types // Depends on your project
 - “Tell me about N-queens”, “What is N ?”
 - “Solve for N=4?”
 - “Why is this a solution? ”
- Handle chitchat // Support at least 5, extensible from a file
 - “Hi” => “Hello”
 - ...
- *Store session details in a file*

Illustrative Project

1. **Title:** Solve and explain solving of n-queens puzzle
2. **Key idea:** Show students how a course project will look like
3. **Who will care when done:** students of the course, prospective AI students and teachers
4. **Data need:** n: the size of game; interaction
5. **Methods:** search
6. **Evaluation:** correctness of solution, quality of explanation, appropriateness of chat
7. **Users:** with and without AI background; with and without chess background
8. **Trust issue:** user may not believe in the solution, may find interaction offensive (why queens, not kings? ...)

Project Discussion: Illustration

1. Create a private Github repository called “CSCE58x-Fall2023-<studentname>-Repo”. Share with Instructor (biplav-s) and TA (kausik-l)
2. Create Google folder called “CSCE58x-Fall2023-<studentname>-SharedInfo”. Share with Instructor (prof.biplav@gmail.com) and TA (lakkarajukausik90@gmail.com)
3. Create a Google doc in your Google repo called “Project Plan” and have the following by next class (Sep 5, 2023)

1. **Title:** Solve and explain solving of n-queens puzzle
2. **Key idea:** Show students how a course project will look like
3. **Who will care when done:** students of the course, prospective AI students and teachers
4. **Data need:** n: the size of game; interaction
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6. **Evaluation:** correctness of solution, quality of explanation, appropriateness of chat
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Project Illustration: N-Queens

- Sprint 1: (Sep 12 – Oct 5)
 - **Solving**: Choose a decision problem, identify data, work on solution methods
 - Method 1: Random solution
 - Method 2: Search – BFS
 - Method 3: Search - ...
 - **Human interaction**: Develop a basic chatbot (no AI) as outlined
 - Deliverable
 - Code structure in Github
 - ./data
 - ./code
 - ./docs
 - ./test
 - Presentation: Make sprint presentation on Oct 12, 2023

Reference: Project Rubric

- **Project results – 60%**
 - Working system ? – 30%
 - Evaluation with results superior to baseline? – 20%
 - Considered related work? – 10%
- **Project efforts – 40%**
 - Project report – 20%
 - Project presentation (updates, final) – 20%
- **Bonus**
 - Challenge level of problem – 10%
 - Instructor discretion – 10%
- **Penalty**
 - Lack of timeliness as per announced policy (right) - up to 30%

Milestones and Penalties

- Oct 12, 2023
 - Project checkpoint
 - In-class presentation
 - **Penalty: presentation not ready by Oct 10, 2023 [-10%]**
- Nov 30, 2023
 - Project report due
 - **Project report not ready by date [-10%]**
- Dec 5 / 7, 2023
 - In-class presentation
 - **Project presentations not ready by Dec 4, 2023 [-10%]**

Lecture 19: Summary

- We talked about
 - Neural Networks
 - Deep Learning
 - Trust Issues

Concluding Section

About Next Lecture – Lecture 20

Lecture 20: Deep Learning, Large Language Models

- Deep Learning
- Language Models (LM)
- Text processing and LLM