AI INSTITUTE #AIISC
UNIVERSITY OF SOUTH CAROLINA

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CSCE 590-1: Trusted AI

Lecture 19: AI Unstructured Text - Trust Issues

PROF. BIPLAV SRIVASTAVA, AI INSTITUTE

26TH OCT, 2021

Carolinian Creed: "I will practice personal and academic integrity."

Organization of Lecture 19

- Introduction Segment
  - Recap from invited talks

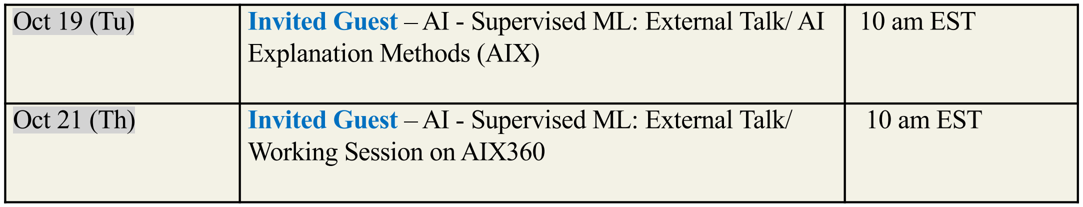
- Main Segment
  - Review of explanation methods
  - Usage of AIX 360 tool
  - Quiz 3

- Concluding Segment
  - About next lecture – Lecture 20
  - Ask me anything

Introductory Segment

Recap of Lectures 17-18 (Explanation) Lectures

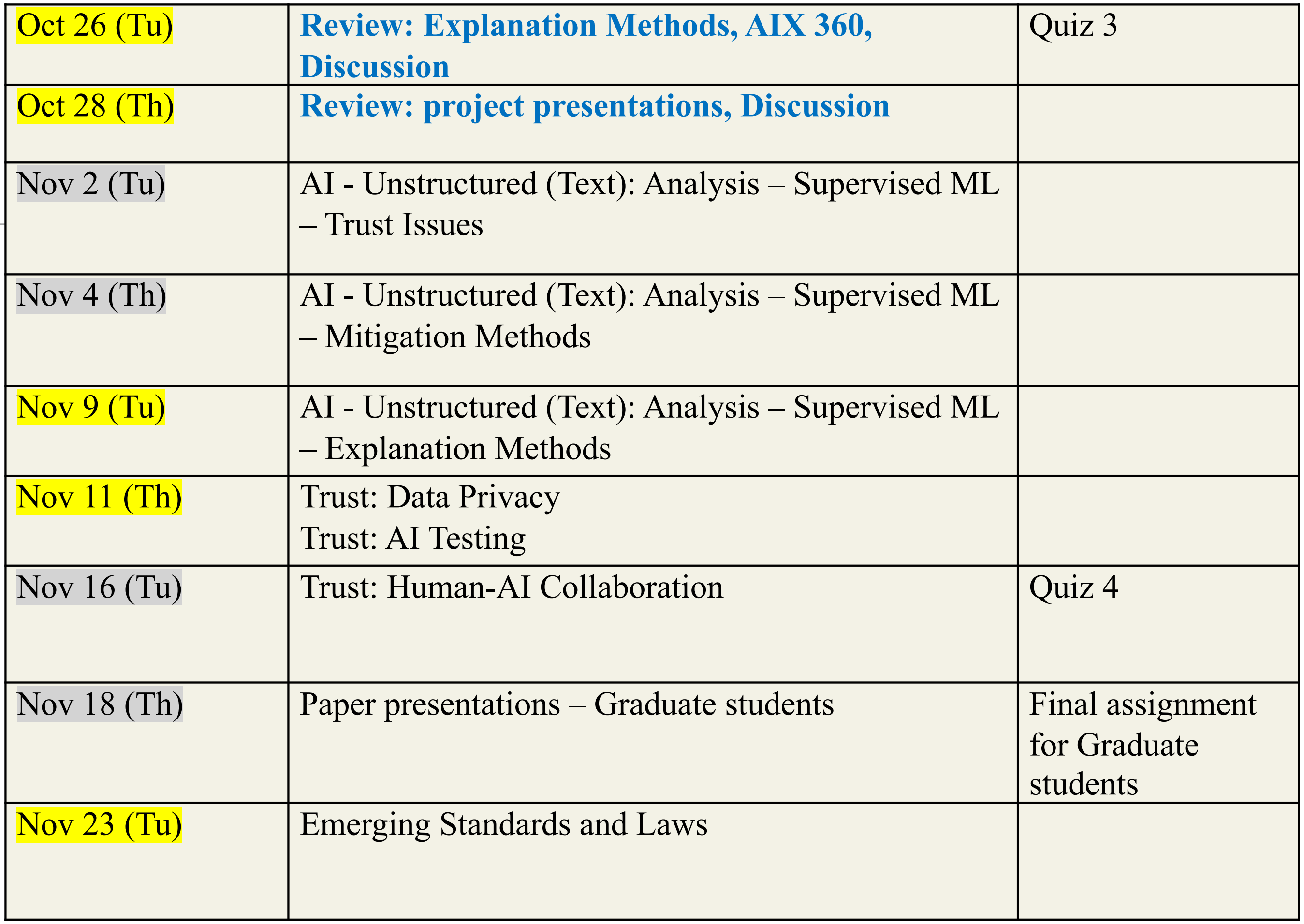
- We looked at explanations for AI in general and IBM point of view
- AIX 360 tool



Oct 19 (Tu)	**Invited Guest** – AI - Supervised ML: External Talk/ AI Explanation Methods (AIX)	10 am EST
Oct 21 (Th)	**Invited Guest** – AI - Supervised ML: External Talk/ Working Session on AIX360	10 am EST

Class 10: Sep 21, 2021: AI Fairness, Diptikalyan Saha
https://lnkd.in/eyJv_XEd
Class 11: Sep 23, 2021: AI Fairness, Diptikalyan Saha
https://lnkd.in/eJFWdwci
Class 17: Oct 19, 2021: AI Explainability, Diptikalyan Saha and Vijay Arya
https://lnkd.in/evtSv_5x
Class 18: Oct 21, 2021: AI Explainability, Vijay Arya
https://lnkd.in/ee28YVE7

Schedule Snapshot



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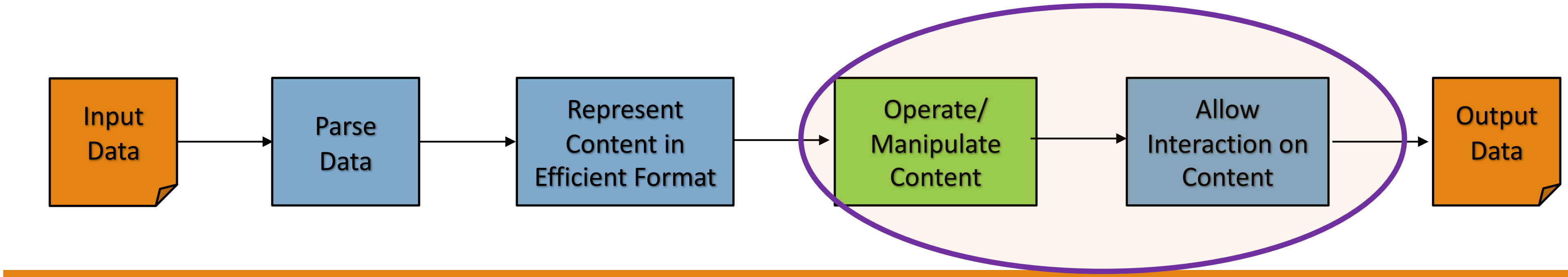
Nov 23 (Tu)	Emerging Standards and Laws	

Main Segment


Input Data
Parse Data
Represent Content in Efficient Format
Operate/ Manipulate Content
Allow Interaction on Content
Output Data

What is the Purpose of Explanations (Human or AI)

- Explanation and understanding
  - Frank C Keil, https://pubmed.ncbi.nlm.nih.gov/16318595/
- Purposes for explanations in **psychology**
  - To predict similar events in the future: *slippery roads can cause a fall*. Use information later.
  - For diagnosis: *why a system failed and then repair a part to bring it back to its normal function*
  - To affix blame: *for a crime*
  - To justify or rationalize an action: *sweet to an enemy because of the strategic value of being nice on that occasion*
  - In the service of aesthetic pleasure

Source: Lecture 9, Trusted AI, Fall 2021

Terminology Review

- **Decision:** an outcome from an AI/ machine learning model
- **Explanation**: **any information provided** in addition to the decision
- **Interpretable explanation**: an explanation that makes sense to the user **to understand the rationale behind the decision**
- **Intelligible (useful) explanation**: an explanation that helps a user understand the rationale behind the decision **to accept the decision**

Terminology Review - Illustration

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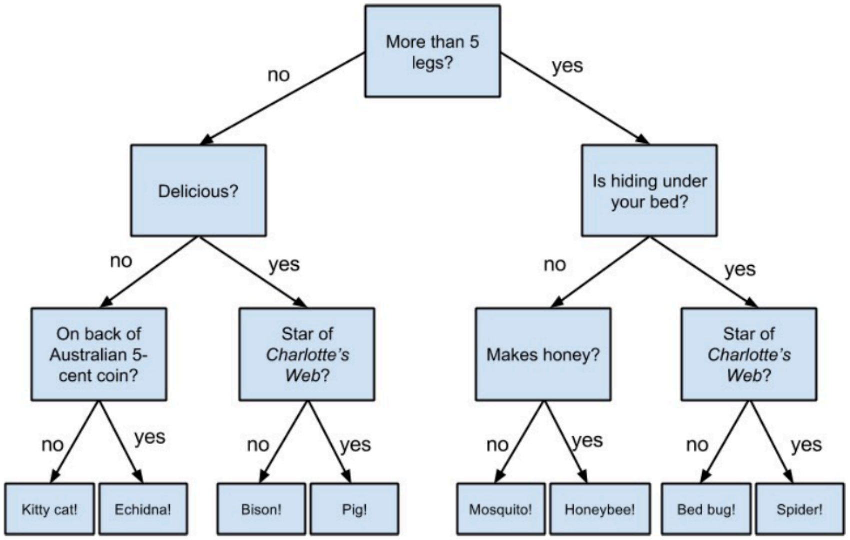
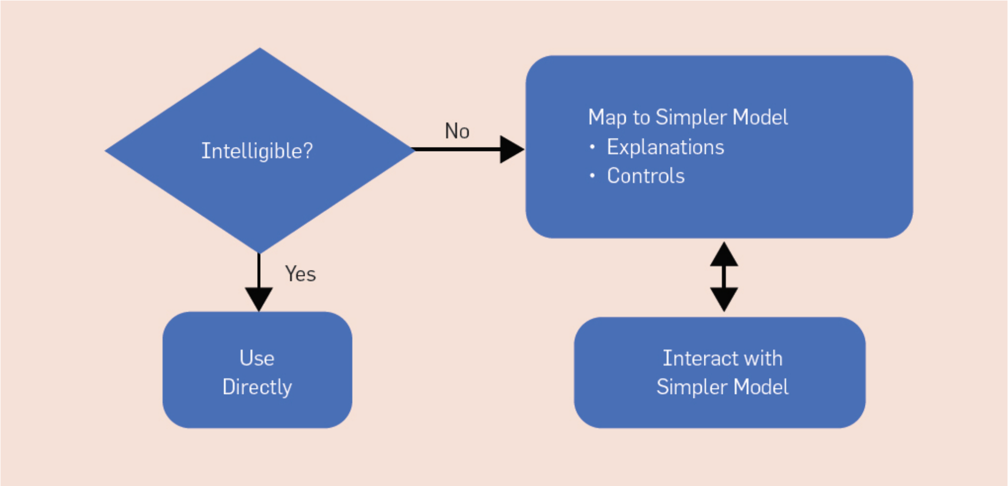
Decision Tree



Not a useful explanation for animal classification

Figure Credit: Diptikalyan Saha and Vijay Arya, Oct 2021

Setting and Terminology: Intelligible Models and Explanations



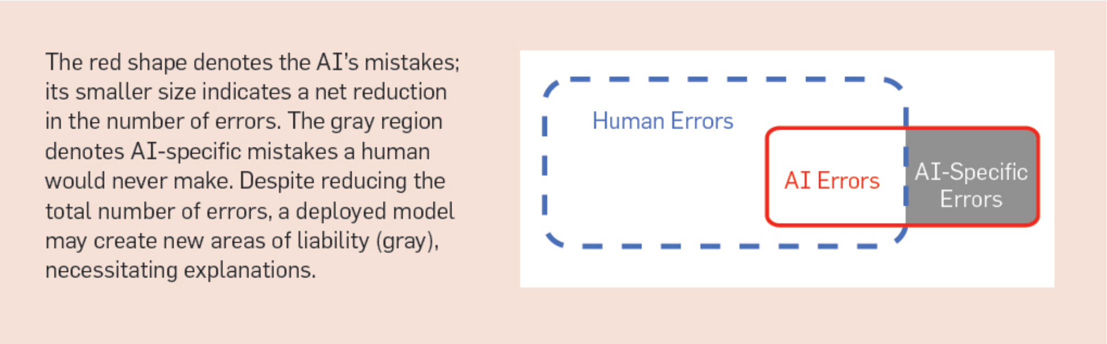
- Transparency: providing stakeholders with relevant information about how a model works
- Explainability: Providing insights into model's behavior for specific datapoints

Source: Lecture 9, Trusted AI, Fall 2021

Sources:

1. The Challenge of Crafting Intelligible Intelligence, Daniel S. Weld, Gagan Bansal, Communications of the ACM, June 2019, Vol. 62 No. 6, Pages 70-79, 10.1145/3282486
2. Explainable Machine Learning in Deployment, FAT* 2020.

Need for Intelligibility



The red shape denotes the AI's mistakes; its smaller size indicates a net reduction in the number of errors. The gray region denotes AI-specific mistakes a human would never make. Despite reducing the total number of errors, a deployed model may create new areas of liability (gray), necessitating explanations.

- **AI may have the wrong objective:** is AI right for the right reasons?
- **AI may be using inadequate features:** understand modeling issues
- **Distributional drift:** detect when and why models are failing to generalize
- **Facilitating user control:** guiding what preferences to learn
- **User acceptance:** especially for costly actions
- **Improving human insight:** improve algorithm design
- **Legal imperatives**

Source: Lecture 9, Trusted AI, Fall 2021

Source: The Challenge of Crafting Intelligible Intelligence, Daniel S. Weld, Gagan Bansal, Communications of the ACM, June 2019, Vol. 62 No. 6, Pages 70-79, 10.1145/3282486

In AI, Stakeholders for Explanations

- Executives
  - Explainability as a market differentiator. Do we need explanations?
- ML engineers
  - How to improve model’s performance?
- End-users
  - Understand business decisions emanating from usage of AI
    - Why was my load denied?
    - Why a particular treatment was recommended or de-prioritized ?
- Regulators
  - Prove that you did not discriminate based on existing laws

Source: Lecture 9, Trusted AI, Fall 2021

Source: Explainable Machine Learning in Deployment, FAT* 2020, https://arxiv.org/pdf/1909.06342.pdf; Video: https://www.youtube.com/watch?v=Hofl4uwxtPA

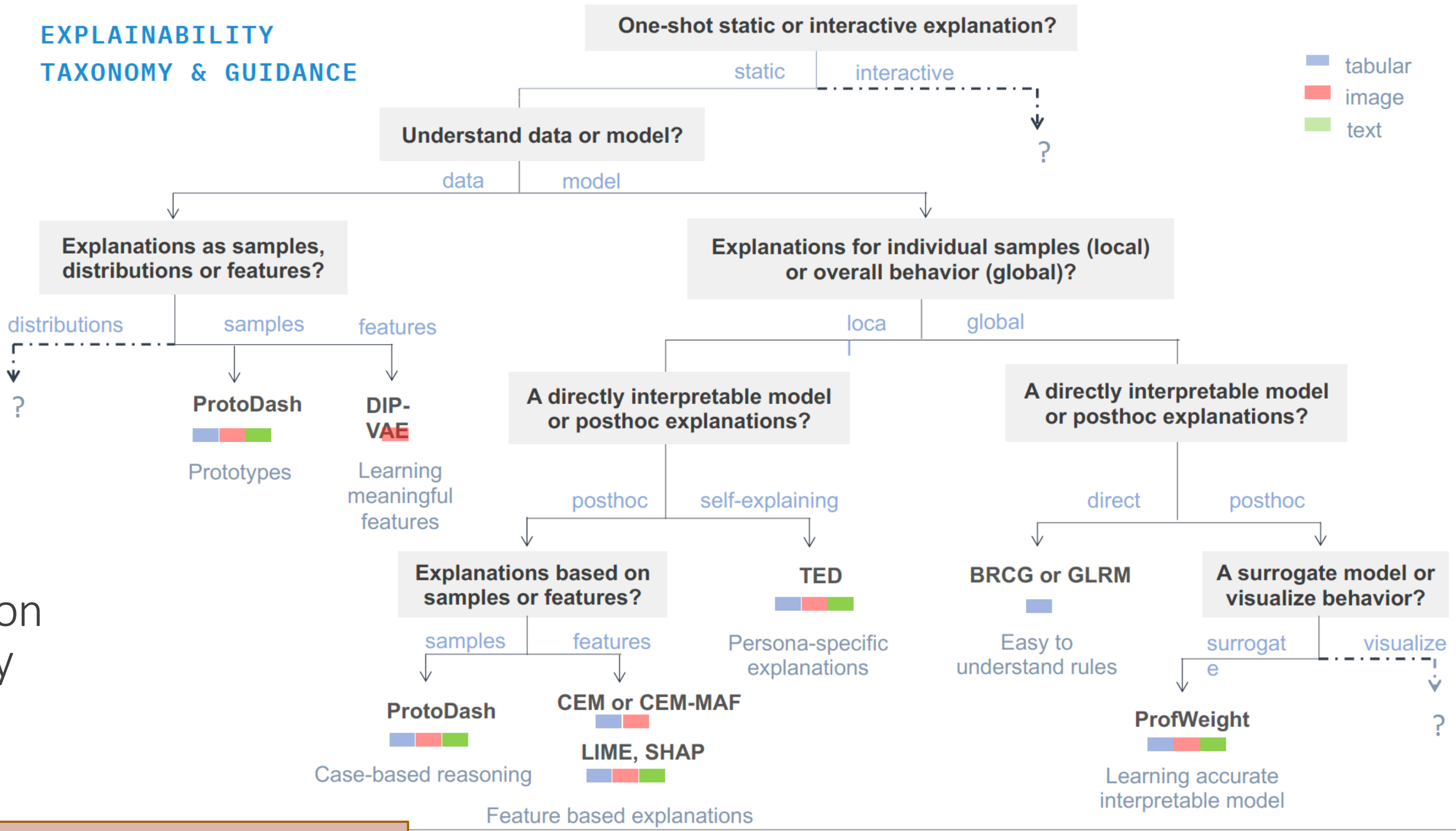
Types of Explanations

- **Feature-based**: from the features of the data, which feature(s) were most important for given decision output
  - Example: For a loan, is it income or the person's age ?
- **Sample-based**: from data in training, which data points were important for given test point; helps understand sampling and its representation in wider population
  - Example: For a loan, what instances similar to the loan application would have gotten the loan ?
- **Counter-factual**: what-ifs – what do you change about the input to change the decision output
  - Example: For a loan, does getting an additional borrower insurance increase chance of getting the loan?
- Natural language

Source: Lecture 9, Trusted AI, Fall 2021

Source: Explainable Machine Learning in Deployment, FAT* 2020

Explanation Taxonomy



EXPLAINABILITY TAXONOMY & GUIDANCE

One-shot static or interactive explanation?

static

interactive

?

🟦 tabular

🟥 image

🟩 text

Understand data or model?

data

model

Explanations as samples, distributions or features?

distributions

?

samples

ProtoDash 🟦🟥🟩

Prototypes

features

DIP-VAE 🟥

Learning meaningful features

Explanations for individual samples (local) or overall behavior (global)?

loca l

global

A directly interpretable model or posthoc explanations?

posthoc

Explanations based on samples or features?

samples

ProtoDash 🟦🟥🟩

Case-based reasoning

features

CEM or CEM-MAF 🟦🟥

LIME, SHAP 🟦🟥🟩

Feature based explanations

self-explaining

TED 🟦🟥🟩

Persona-specific explanations

A directly interpretable model or posthoc explanations?

direct

BRCG or GLRM 🟦

Easy to understand rules

posthoc

A surrogate model or visualize behavior?

surrogat e

ProfWeight 🟦🟥🟩

Learning accurate interpretable model

visualize

?

Figure Credit: Diptikalyan Saha and Vijay Arya, Oct 2021

Explanation Methods Covered

- Local Explainability – LIME, ANCHORS
- Global Explainability – TREPAN
- Counterfactual Explainability – Wachter
- HELOC / Credit Rating
  - Loan Officer: ProtoDash - Prototypical explanations
  - Data scientist: Boolean Rule and Logistic Rule Regression models
  - Customer: Contrastive explanations - Pertinent positives and negatives

AIX Tool

- HELOC: https://github.com/Trusted-AI/AIX360/blob/master/examples/tutorials/HELOC.ipynb

Concluding Segment

Preparatory Reading Material

- Blogs:
  - https://medium.com/@diptikalyan?p=5ce7347f5f75
  - https://www.ibm.com/blogs/watson/2021/06/trustworthy-ai-assessment-mitigation/
  - https://www.ibm.com/blogs/watson/2020/10/how-ibm-makes-ai-based-on-trust-fairness-and-explainability/
- Suveys:
  - Fairness: https://arxiv.org/pdf/1908.09635.pdf
  - Explainability: https://christophm.github.io/interpretable-ml-book/
  - AI Testing: https://www.researchgate.net/publication/334048996_Machine_Learning_Testing_Survey_Landscapes_and_Horizons
  - Counterfactual: https://arxiv.org/abs/2010.10596
- Tools:
  - AIF360: https://aif360.mybluemix.net/
  - AIX360: https://aix360.mybluemix.net/

Lecture 19: Concluding Comments

Review of What We Covered

- We reviewed explanation lectures (Lecture 9) and invited speakers (Lectures 17 and 18)
  - Exciting open area, many methods and tools
  - Focused on AIX 360 tool
- Perspective
  - Explanation, types
  - Usage, Taxonomy
- Methods
  - Overview of Three types of Explainability
  - Local Explainability – LIME, ANCHORS
  - Global Explainability – TREPAN
  - Counterfactual Explainability – Wachter
  - Others in AIX tutorials
- Tool
  - Notebook walkthrough of Algorithms in AIX360

Adapted from: Diptikalyan Saha and Vijay Arya, Oct 2021

Quiz 3: Explanation

About Next Lecture – Lecture 20

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Lecture 20:

- Review of Projects
- Use 1-slide template, upload to shared Google drive
  - Template and link shared via slack