

## What's Next?

Date	Session	Topics
April 16	13	VAE, Denoised Diffusion; Latent Diffusion; Diffusion Transformers
April 30, 11:59pm	N.A.	Scribed Lecture Notes Due
May 11, 11:59pm	N.A.	Project Paper, Slides, and Code Due
May 13	N.A.	I need to submit the grades to DOT Department...

- We will **NOT** schedule project presentations in class, but feel free to schedule **individual meetings** with me to discuss about your projects.
- The scribed **lecture notes, project papers, slides, and code** will be shared with the students who take this course for credit.

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Session	Date	Topic	Key Words
1	1.09	AI/ML in a Nutshell	Course Intro, ML Models, Model Evaluations
2	1.16	Intro to DL	DL Intro, Neural Nets, Computational Issues in DL
3	1.23	Prediction and Traditional NLP	Prediction in Biz Research, Pre-processing
4	1.30	NLP (II): Traditional NLP	<i>N</i> -gram, NLP Performance Evaluations, Naïve Bayes
5	2.06	NLP (III): Word2Vec	CBOW, Skip Gram
6	2.20	NLP (IV): RNN	Glove, Language Model Evaluation, RNN
7	2.27	NLP (V): Seq2Seq	LSTM, Seq2Seq, Attention Mechanism
7.5	3.05	NLP (V.V): Transformer	The Bitter Lesson, Attention is All You Need
8	3.12	NLP (VI): Pre-training	Computational Tricks in DL, BERT, GPT
9	3.19	NLP (VII): LLM	Emergent Abilities, Chain-of-Thought, In-context Learning, GenAI in Business Research
10	3.26	CV (I): Image Classification	CNN, AlexNet, ResNet, ViT
11	4.02	CV (II): Image Segmentation and Video Analysis	R-CNN, YOLO, 3D-CNN
12	4.09	Unsupervised Learning (I): Clustering & Topic Modeling	GMM, EM Algorithm, LDA
13	4.16	Unsupervised Learning (II): Diffusion Models	VAE, DDPM, LDM, DIT

## What Happened in the Past 3 Months?

A lot of **Natural Language Processing**.

Some **Computer Vision**.

Some **Unsupervised Learning**.

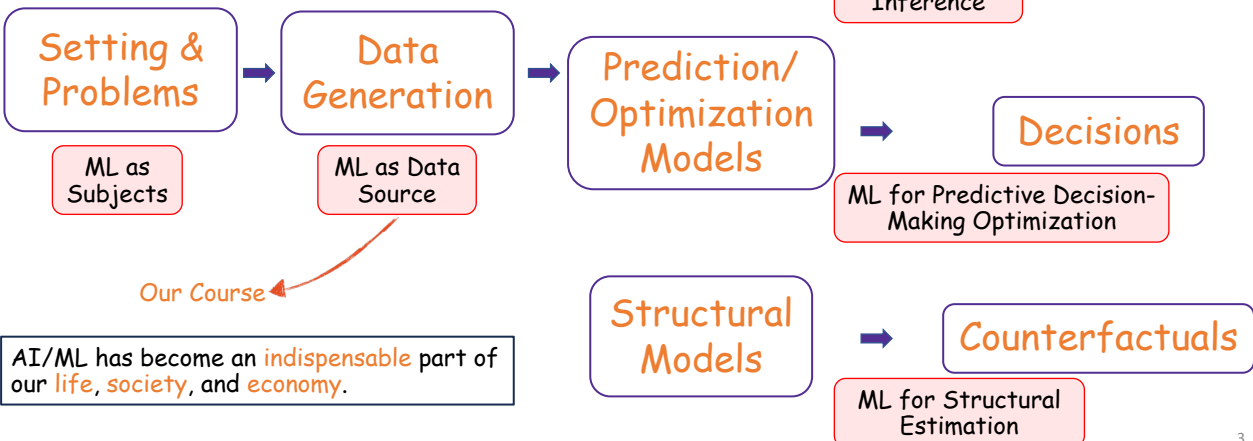
Decent amount of their **applications in biz/econ research**.

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## Application of AI/ML in Business Research

AI/ML could help us obtain the **otherwise unavailable data** that could lead to business **insights** and/or **decisions**.



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## Our Goal

1. Have a basic understanding of the **fundamental concepts/methods** in machine learning (ML) and artificial intelligence (AI) that are used (or potentially useful) in business research.
2. Understand how business researchers have utilized ML/AI and what **managerial questions have been addressed by ML/AI** in the recent decade.
3. Nurture a taste of what the **state-of-the-art AI/ML technologies** can do in the ML/AI community and, potentially, in your own research field.



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## Course Takeaways

- The **necessary knowledge** of AI/ML that could help you:
  - Keep up with the **literature development** in the relevant domains in both CS and business;
  - Develop the **necessary sense** to do **rigorous business research** using the relevant methods;
  - Identify **important and interesting questions** in your own field where AI technologies are useful;
  - Invent new applied methods** (most likely without any theoretical guarantee) in your own research.

Impact of a **CS** Paper = Problem Importance \* **Technical** Novelty \* **Performance** Improvement

Impact of a **Business** Paper = Problem Importance \* **Identification** Rigor \* **Insight** Novelty

- Academic research is a kind of **craft**: You can only learn by **doing it on your own**.
  - So, take your final projects seriously!

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## When Will Things Go Wrong?

- Most AI applications are only useful if actionable insights can be derived:

$$\frac{d\pi(X_0, Y)}{dX_0} = \frac{\partial \pi}{\partial X_0} \underbrace{(Y)}_{\text{prediction}} + \frac{\partial \pi}{\partial Y} \underbrace{\frac{\partial Y}{\partial X_0}}_{\text{causation}}.$$

Your prediction of Y is not accurate.

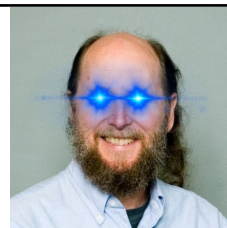
Your causal identification is not clean.

- You should be able to judge whether you should seek for **accurate prediction** and/or **clean identification**.
- Empirical model:  $Y = a + b \cdot D + g(X) + \epsilon$ 
  - Key parameter of interest:  $b$
  - If  $D$  is predicted by a ML model, the prediction error is likely to be correlated with  $\epsilon$ , giving rise to the bias to estimate  $b$ .

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## The Bitter Lesson



- Reference: <http://www.incompleteideas.net/IncIdeas/BitterLesson.html>
- The biggest lesson that can be read from 70 years of AI research is that **general methods that leverage computation** are ultimately the most effective, and by a large margin.
- Leveraging domain knowledge (short-term & specific) vs. Leveraging computation (long-term & general).
- Bitter lesson: Leveraging domain knowledge is **self-satisfying** and **intellectually inspiring**, but plateaus in the long-run or even inhibits further progress.
- **Are you ready to control the machine intelligence to create great knowledge?**

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## What to Expect Next Year?

- This course will be offered **again in the next AY**.
- What to expect:
  - Deep Dive into **Generative AI**
    - Use AI to (a) **generate strategies/content** valuable to business; and (b) **simulate human behaviors** in response to business strategies.
  - AI/ML-based **Causal Inference** (<https://causalml-book.org/>)
  - **Reinforcement Learning**
  - **AI Ethics/Safety/Society** (not sure whether AI will become a new species then.....)  
<https://www.aisafetybook.com/>
- **Stay tuned and hope to see you all again!**

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## Keep in Touch

- Stay in contact and keep me posted of your academic and career successes.
- Feel free to send me an email/WeChat message. I am always happy to discuss topics related to AI research and business. We may work on something interesting together ☺
- Let me know if you need a job referral from me to comment on your academic/career potential.

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## Finally

Thank You & All the Best!

谢谢！  
祝前程似锦！

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Hope to see you all again!

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