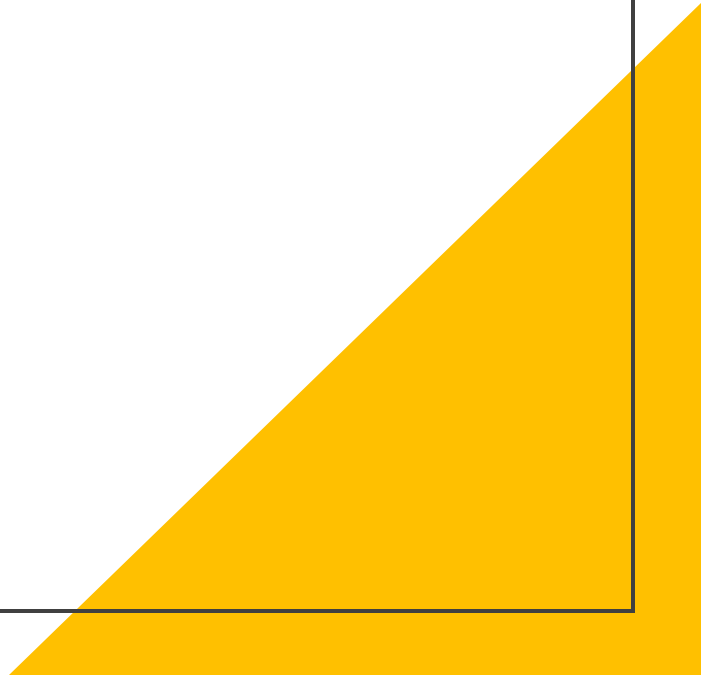


Power and prediction

Innovation using AI
Seminary 3



Contents

1. Where are we?
2. Challenges
3. Ethics
4. Demo
5. Milestones



Power and Prediction



The Disruptive Economics of
Artificial Intelligence

AJAY
AGRAWAL

JOSHUA
GANS

AVI
GOLDFARB

Where are we?

- "Power and Prediction" by Ajay Agrawal, Joshua Gans, and Avi Goldfarb
- In the *Between Times* (advanced enough to but not yet mature enough)
 - Electricity from 1880 to 1920
 - Computers from 1960 to 1980
 - AI (2010s–Present)
 - Many organization rely on traditional methods for decision-making
 - Highly depending on qualitative data
 - High costs of computing



AI Winter is co

AI winters

- 1974–1980

- Early AI research in the 1950s and 1960s promised rapid advancements
- Early AI research in the 1950s and 1960s promised rapid advancements
- machine translation and speech recognition failed to meet the ambitious expectations

- 1987–2000

- expert systems (rule-based AI) were successfully applied in industries. However they were costly, hard to scale, and difficult to maintain
- Symbolic AI (logic-based and rule-based) began to show its limitations
- the death of one computing technology



Where to apply?

- Today AI is not artificial general intelligence
... it is a prediction technology
- Predictions **help** to make decision
- Decisions are made by **humans**
- Examples:
 - Insurance costs
 - Patients' triage/diagnostics
 - Human resources

An abstract graphic on the left side of the slide, featuring concentric circles and various data patterns, including bar charts and line graphs, in shades of blue and green.

Challenges

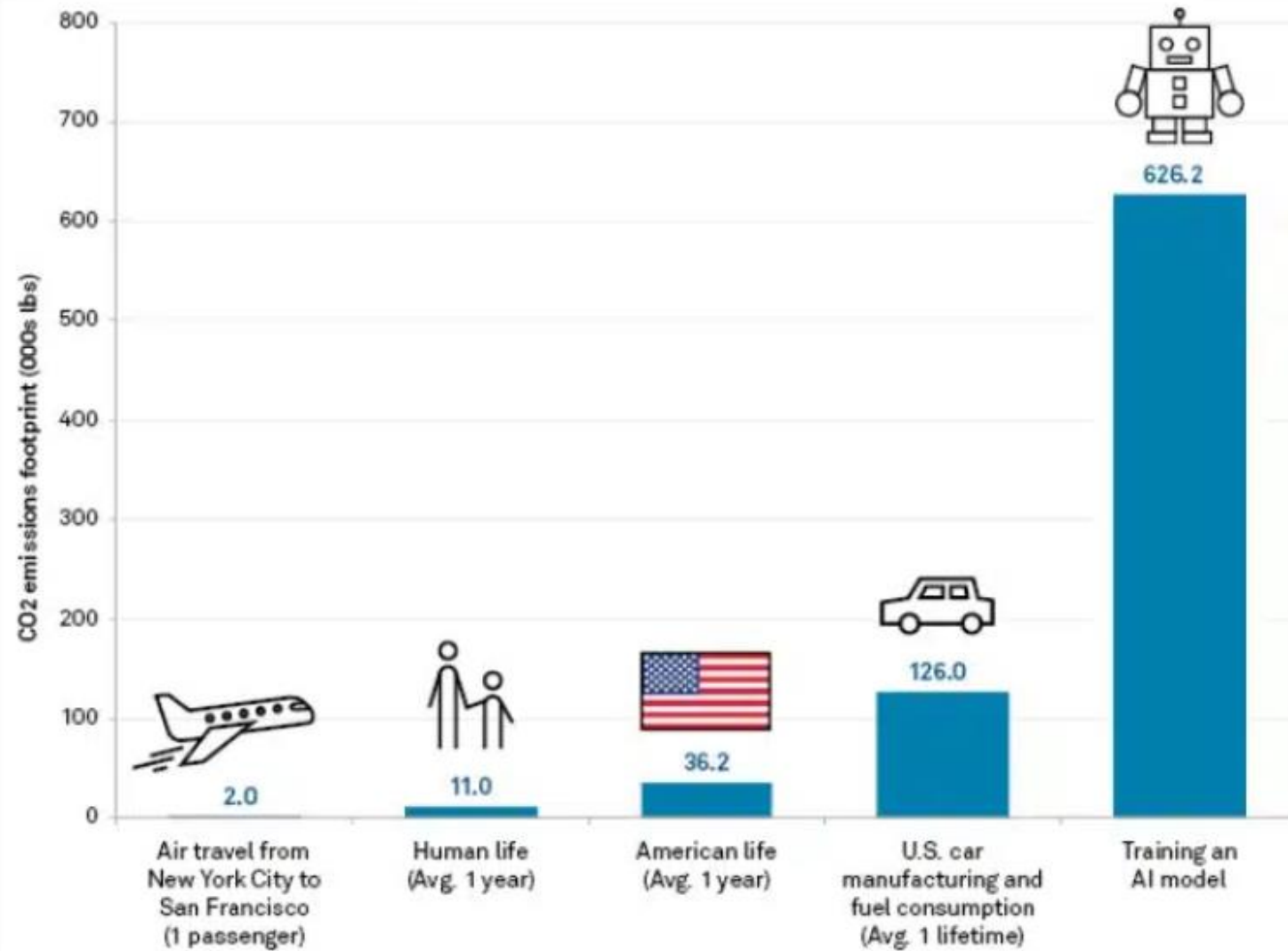
- Data quality and availability
- Computing power
- Integration with existing systems
- Deep-learning algorithms are opaque
- Security flaws
- Lack of expertise
- Costs
- Ethical and legal considerations
 - (data privacy and biases)



Ethics-Concerns

- AI may have embedded bias
- Climate degradation
- Human rights
 - Surveillance
 - News feed algorithm (wave of violence faced by Rohingya Muslims in the Buddhist Myanmar)
- Inequalities
 - Women, minority groups, marginalized people.
 - Bank loans
 - Hiring process

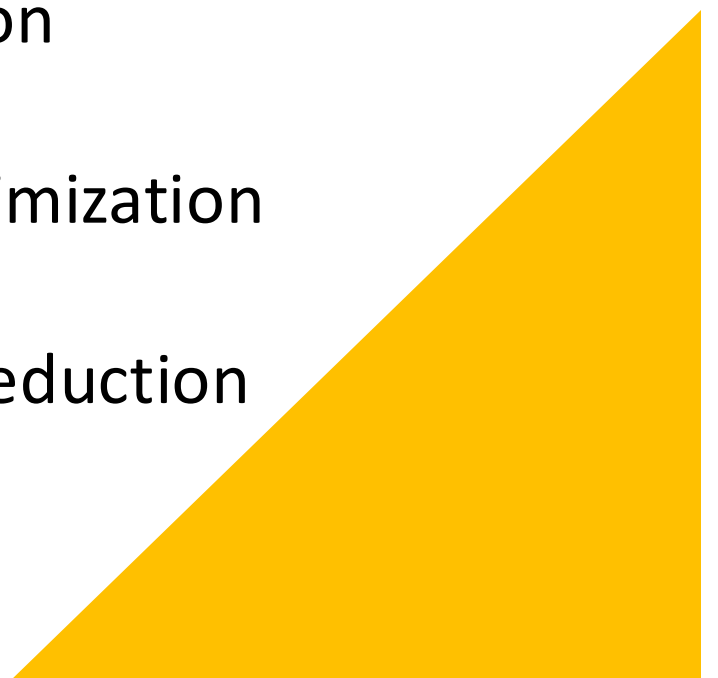
CO2 emission benchmarks



Ethics- UNESCO core principles

1. Risk assessment should be used to prevent harms
2. Unwanted harms (safety risks) as well as vulnerabilities to attack (security risks) should be avoided
3. Privacy must be protected
4. International law & national sovereignty must be respected in the use of data
5. AI systems should be auditable and traceable.
6. Ethical deployment of AI systems depends on their transparency & explainability
7. AI systems do not displace ultimate human responsibility and accountability
8. AI technologies should be assessed against their impacts on 'sustainability',
9. Public understanding of AI and data should be promoted
10. AI actors should promote social justice, fairness, and non-discrimination

AI Tasks

- Classification
 - Regression
 - Segmentation (vision)
 - Clustering
 - Text Generation
 - Summarization
 - Translation
 - Conversational
 - Instructional
 - Information Retrieval
 - Clustering
 - Reinforcement Learning
 - Speech and Audio Processing
 - Anomaly Detection
 - Data Generation
 - Planning and optimization
 - Simulation
 - Dimensionality Reduction
- 

Train an AI model

Steps:

- Requirements
- Data collection
- Data cleaning
- Model training
- Validation
- Deploy
- Integrate in app



1. Requirements

- Input/output
- What data do I need (privacy issues)
- Metrics
- How is the problem solved now?
 - Is it accurate?
- Non-functional requirements?
 - Power, latency?
- Cost?



Data collection

- <https://paperswithcode.com/datasets>
- <https://www.kaggle.com/datasets>
- <https://huggingface.co/docs/datasets/index>

2. Data cleaning

- Handle missing data
 - Dropping rows
 - Fill with mean value of the column
 - Fill with a random value
 - Multiple imputation prediction (KNN, ANN)
- Remove unnecessary columns
 - Variables that only have a single value
 - Variables with very few unique values
 - Duplicate observations
- Transform any categorical features to numbers/vectors
 - Scale numerical features



Data cleaning for text retrieval task

- **Handle Missing or Incomplete Data**

- **Remove Empty Documents:** If entire text documents or entries are blank, remove them.
- **Fill Missing Fields:** Use strategies such as filling with default phrases, or merging information from other fields, especially in cases where metadata is relevant.

- **Text Normalization**

- **Lowercase:** Convert all text to lowercase to reduce redundancy.
- **Remove Punctuation and Special Characters:** Strip unnecessary symbols unless they carry semantic importance (like hashtags).
- **Expand Contractions:** Ensure words like "can't" are expanded to "cannot" for better tokenization.
- **Lemmatize/Stemming:** Reduce words to their base or root form to unify variations.

- **Remove Stop Words**

- Commonly used words (like "and," "the," "is")

- 4. **Filter Out Irrelevant or Low-Quality Text**

- **Short Documents:** Filter out documents with too few tokens as they may not contribute useful information.
- **Spam/Irrelevant Text:** Use automated methods or rule-based filters to eliminate non-informative content like ads or repetitive phrases.

- **Handle Duplicates**

- Detect and remove duplicate sentences, phrases, or entire documents to avoid redundancy.

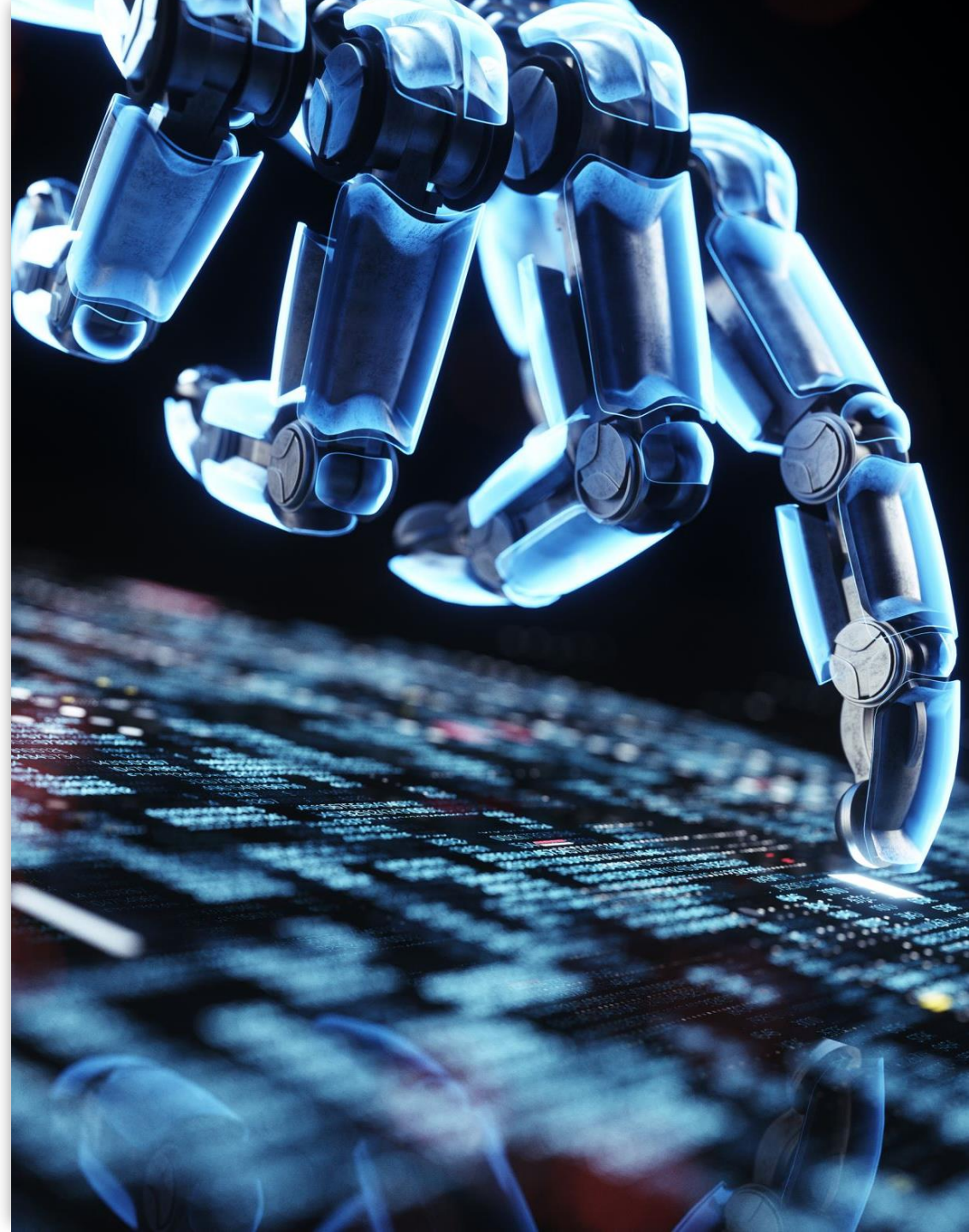
Demo: Train & Validation

- Vision:
<https://colab.research.google.com/drive/1NhGFWMCyjoZeH65098Vf8Syz3PEZswNA?usp=sharing>
- LLM:
<https://colab.research.google.com/drive/1fsxq51kq5sC-yo5cla6S36SYknMZOHoq?usp=sharing>



Wrap-Up Innovation using AI

- Personalized Customer Experiences
- Chatbots and Virtual Assistants
- Robotic Process Automation (RPA):
 - Automate repetitive tasks
- Enhanced Decision-Making
- Customer Insights and Market Research
- Enhanced Security and Fraud Detection





Milestones

- **One page** essay how you (will) use AI in your project
 - Define your goals (2p)
 - Choose a programming language and framework (2p)
 - Collecting/cleaning data (2p)
 - Training the algorithm (1p)
 - Validation dataset and testing (2p)



References

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