KENT STATE UNIVERSITY

Data Visualization in AEC

Ruoxin Xiong, Ph.D.

Assistant Professor of Construction Management

rxiong3@kent.edu

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Last Discussion:

Part 1: Identifying Challenges

1. list 1-2 major challenges currently facing the AEC industry.
   o Think about: workforce, cost, schedule, safety, sustainability, technology, regulations.
2. For each challenge:
   o How serious is it (low / medium / high)?
3. Choose one challenge you believe is the most urgent.
   o Explain why you chose it.

Part 2: Evaluating AI as a Solution

1. Could AI help address your selected challenge?
   o If yes, how specifically?
   o If no, why not?
2. What potential risks or concerns of using AI in this context:
   o Technical (errors, reliability)
   o Human (trust, skill loss)
   o Ethical or legal (accountability, bias, safety)

Wrap-up (AI benefits)

- They are "Cool"?

Wrap-up (AI benefits)

- ~~They are "Cool"?~~
- Productivity and Workload Pressure
- Efficiency and Time Savings
- Access to Knowledge and Expertise
- Lower Barrier to Entry

…

(You may have more thoughts at the end of this semester, and the discussion never really ends!)

Wrap-up (AI Risks)

- Privacy
- Transparency
- Copyrights
- Hallucination
- Job displacement Loss
- False information

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Be Aware of AI/ML Risks!

Computer Facts
@computerfact

concerned parent: if all your friends jumped off a bridge would you follow them?

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2:20 PM · Mar 15, 2018

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Professional Responsibility When Using AI

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- You **MUST** double check the **ALL** outputs
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AI can assist your work, but it cannot take responsibility for it — that responsibility is always yours.

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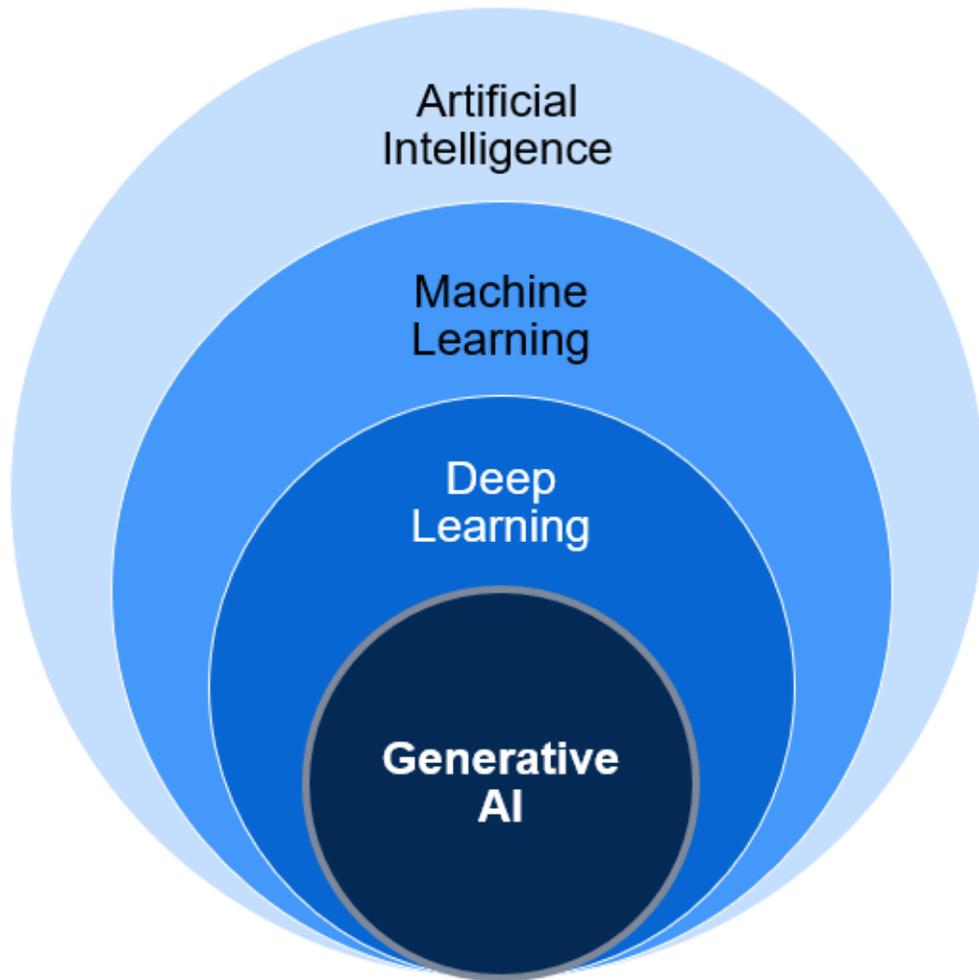
What is AI?

Artificial Intelligence (AI)

Generative Artificial Intelligence (GAI)

Machine Learning (ML)
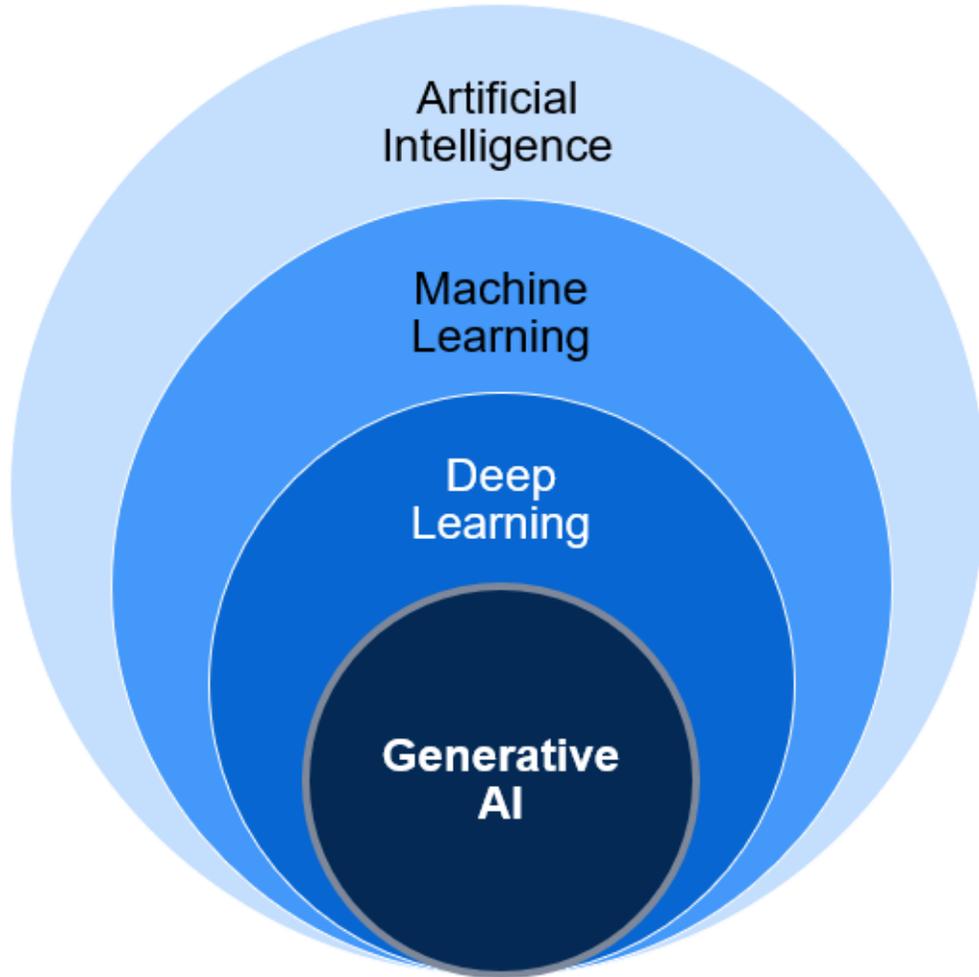
Deep Learning (DL)

The AI Landscape

- AI is the broad field of computer science focused on creating **machines capable of performing tasks that typically require human intelligence**

The AI Landscape

Artificial
Intelligence

Machine
Learning

Deep
Learning

**Generative
AI**

- ML is a subset of AI involving algorithms and statistical models that enable computers to **improve their performance on a task through examples**

The AI Landscape

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**Generative
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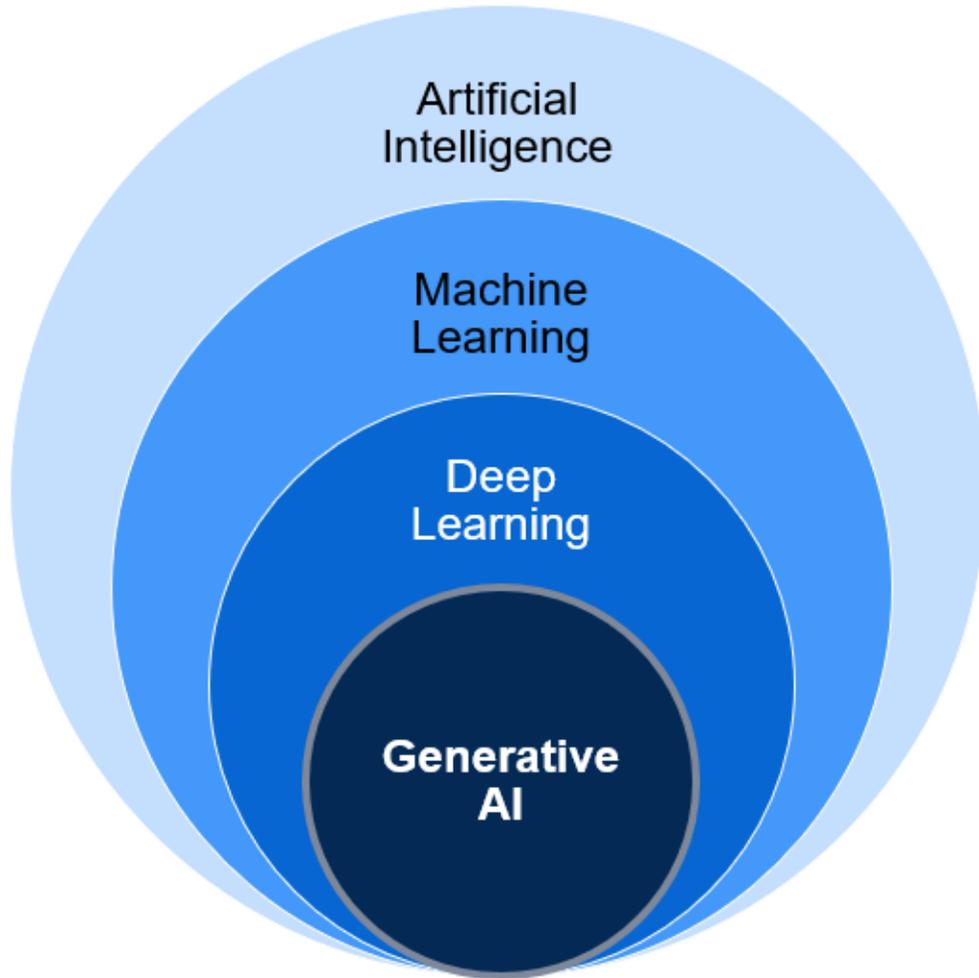
- DL is a subset of ML based on **artificial neural networks**, where algorithms learn from **large amounts of data** to identify patterns and make decisions

The AI Landscape
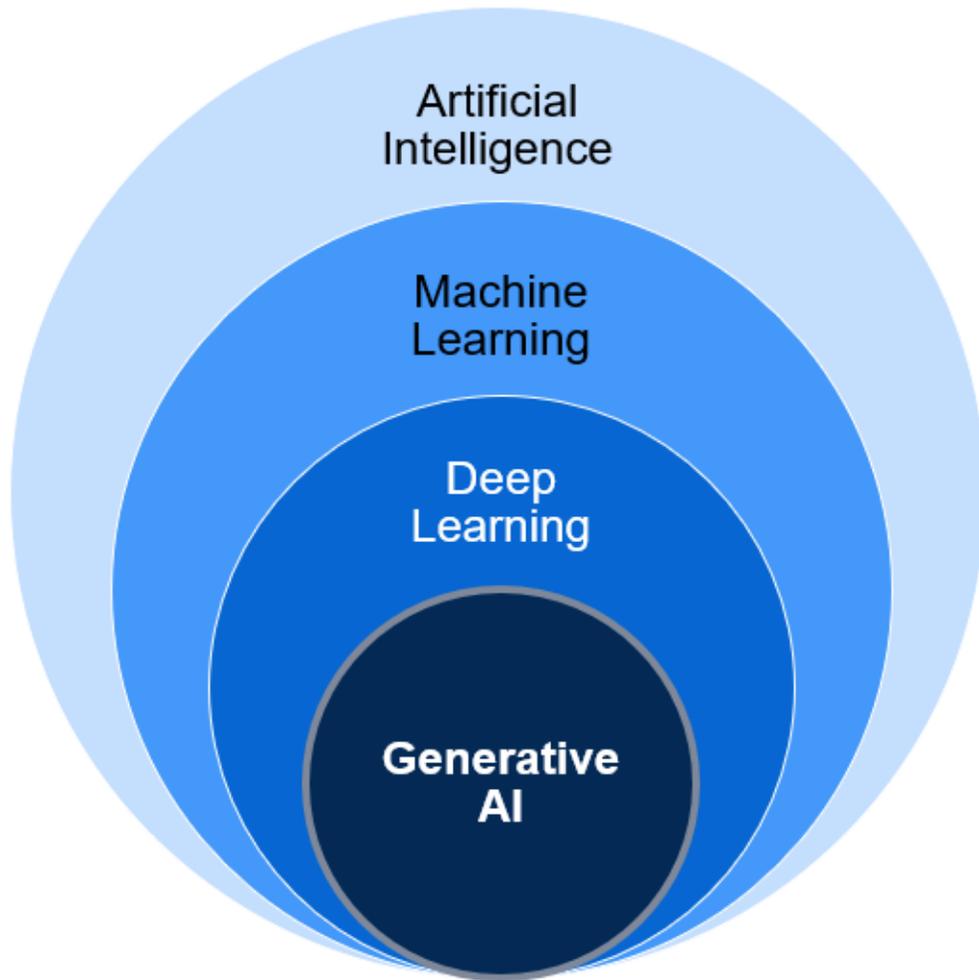
- GAI refers to AI technologies that can **generate new content, ideas, or data** that are coherent and plausible, often resembling human-generated outputs

AI's power comes from large-scale, high-quality data
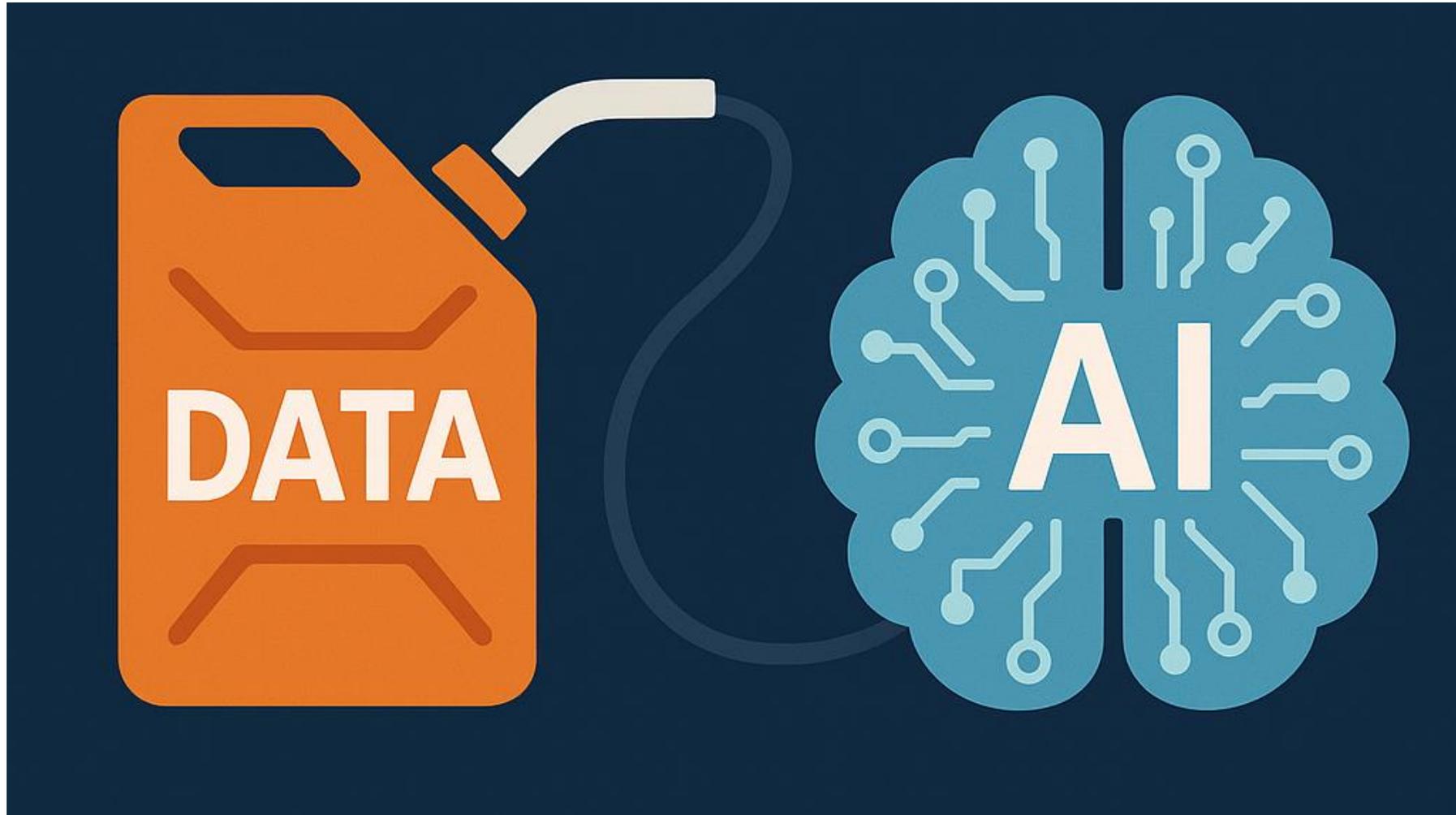
Examples of AEC data

- Drawings & BIM models
- Schedules, cost estimates, quantities
- Site photos & videos
- Daily reports, RFIs, change orders
- Sensors (IoT, wearables, equipment logs)

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What Can We Get from Data and why we need to collect and analyze the data?

What Can We Get from Data and why we need to collect and analyze the data?

- What is happening and why?

Examples:
- *Photos → detect safety hazards*
- *Schedules → identify bottlenecks*
- *Cost data → reveal overrun drivers*

What Can We Discover from Data?

- **Patterns** (e.g., recurring delays, defects)
- **Trends** (cost growth, productivity decline)
- **Anomalies** (unsafe behavior, abnormal energy use)
- **Relationships** (design choices ↔ construction issues)

Data is not the goal
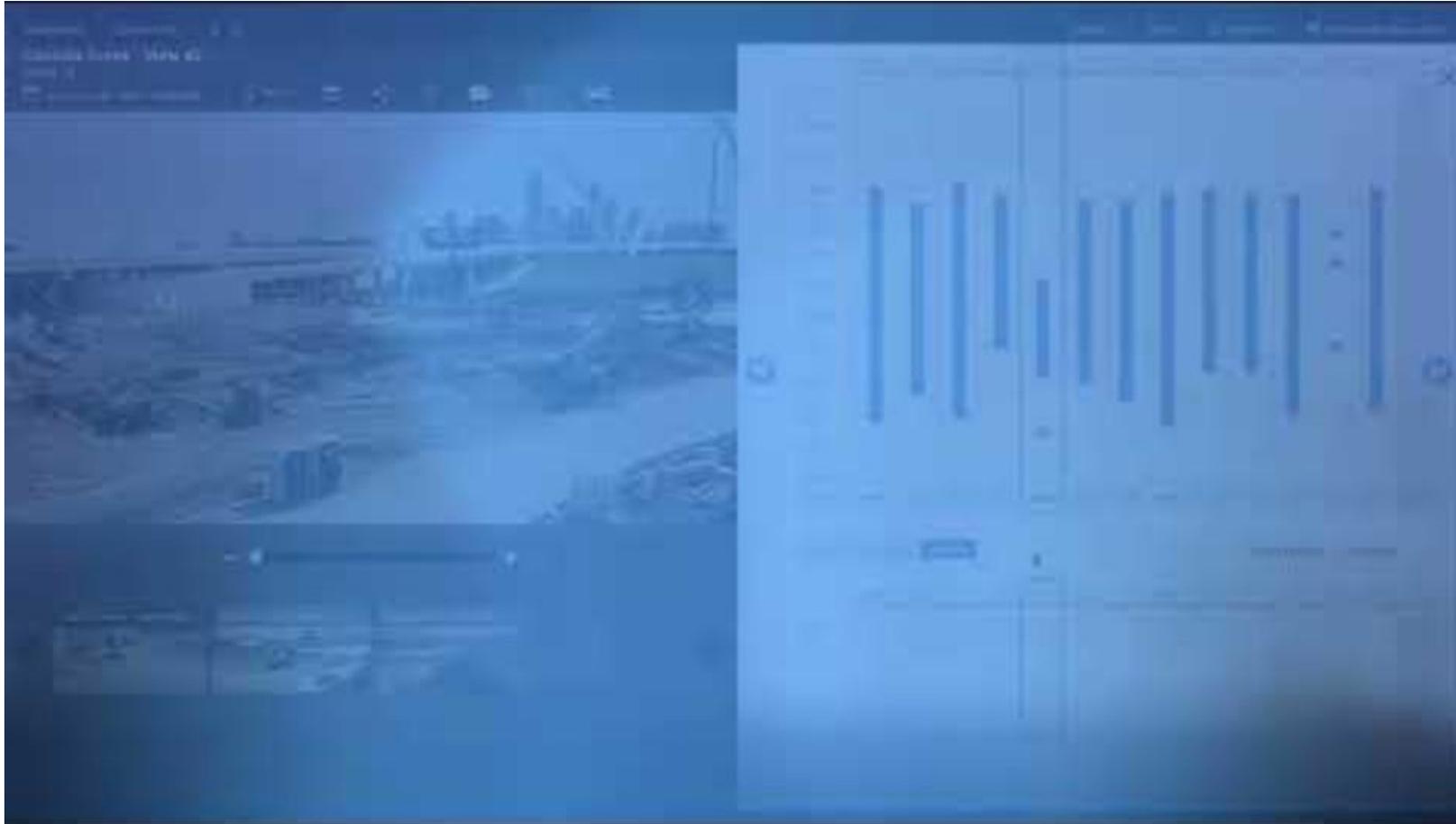
Data → Insights → Decisions → Actions

- Data alone has no value
- Value is created when data changes decisions and actions
- AEC data exists across design, construction, and operations

Some examples

You will have **hands-on experience** and learn **how to build a sensing system to gather essential data** using Raspberry Pi!

Some examples

You will have **hands-on experience** and learn **train an AI system** to automatically detect construction equipment!

The Unused Data Problem

Most AEC data stays unused **~95.5%** of all data collected in the engineering & construction industry goes unused [1].

This means only ~4.5% is meaningfully analyzed or leveraged for insight.

[1] https://www.forconstructionpros.com/business/press-release/21031884/fmi-corp-study-95-of-all-data-captured-goes-unused-in-the-ec-industry

Unused data = missed value

- Most firms collect many data types but only translate a few into decisions.

- This gap means lost opportunities in productivity, quality, safety, costs, and innovation.

- Companies with strong data use can outperform peers (e.g., higher profit growth).

Key reasons for such low utilization?

Key reasons for such low utilization?

- Data stored across systems and teams

- Lack of structured data frameworks

- Limited analytics skills and tools

- Focus on collection rather than actionable insights

Turning unused into usable

https://www.openconstruction.org/

You are welcome to contribute to this initiative!

Let us take a break!

- **We will be back at 7:00 pm**

Python for Data Analysis and AI

Python is one of the most widely used tools for data analysis and visualization

- Easy to learn, readable syntax
- Powerful libraries for data analysis & visualization
- Widely used in engineering, data science, and AI
- Free and open-source

Python: Excel + automation + visualization + scalability

With Python, you can:

- Load and clean data (CSV, Excel)
- Analyze patterns and trends
- Create plots and charts
- Automate repetitive analysis
- Support data-driven decisions

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You don't need to build everything from scratch

Typical **Python Libraries** We Will Use:

- pandas → data tables & analysis
- numpy → numerical computing
- matplotlib → basic plotting
- seaborn → nicer statistical plots

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What Is Google Colab?

Google Colab is a free, cloud-based platform for running Python code.

- No installation required
- Runs in your web browser
- Free access to computing resources
- Easy sharing and collaboration
- Integrates with Google Drive

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How This Helps Your Career

- Work with real project data
- Communicate insights clearly
- Collaborate with data/AI teams
- Prepare for data-driven AEC workflows

Do You Need Programming Experience?

No.

- We start from basics
- Focus on using Python, not becoming a software engineer
- Code examples will be provided
- Emphasis on understanding results, not memorizing syntax

Thank You!