

# AI in Systems Engineering Education: A Review of Curricula and Training Programs in the U.S.

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# Overview



Introduction and Objectives



Methodology



Results and Discussions



Conclusions and Recommendations

# Introduction

## Systems Engineering Rising Challenges

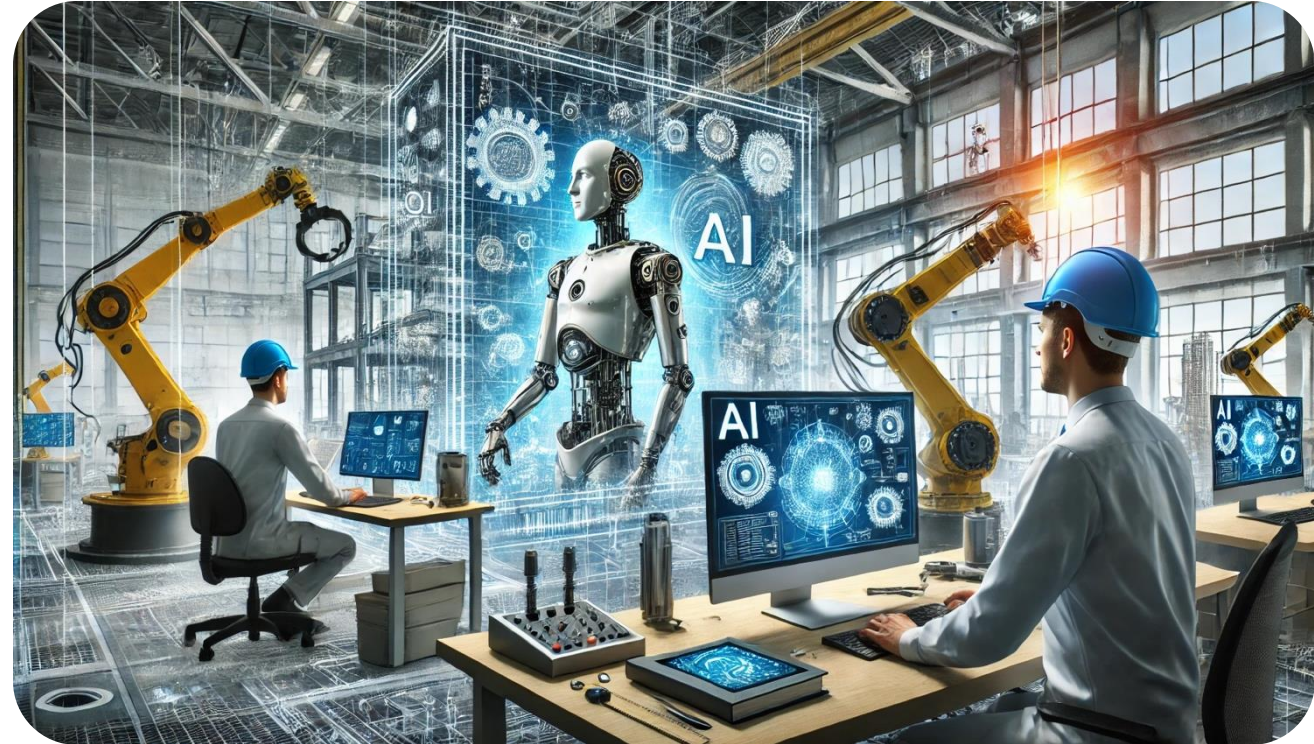
- Growing **system complexity**
- **Uncertainty & rapid decision-making**
- Need for **data-driven** approaches

## Role of Artificial Intelligence (AI)

- Supports modeling, simulation, and optimization
- Enables data-driven insights for industry and academic research

## Educational Transformation

- Requires new pedagogy and **curriculum design**
- Embeds AI into systems engineering framework
- Balances technical, organizational and ethical considerations



# Objectives



To develop a general understanding of **current SE courses** and programs offered by universities in the U.S., with the special focus on **AI-related content**.



To support and inspire **future development of AI-integrated SE curriculum** by offering insights and recommendations grounded in the current educational landscape.

# Methodology

Data source identification

US News + ABET+ SERC + INCOSE

Curriculum review

Description + Syllabi + Introduction

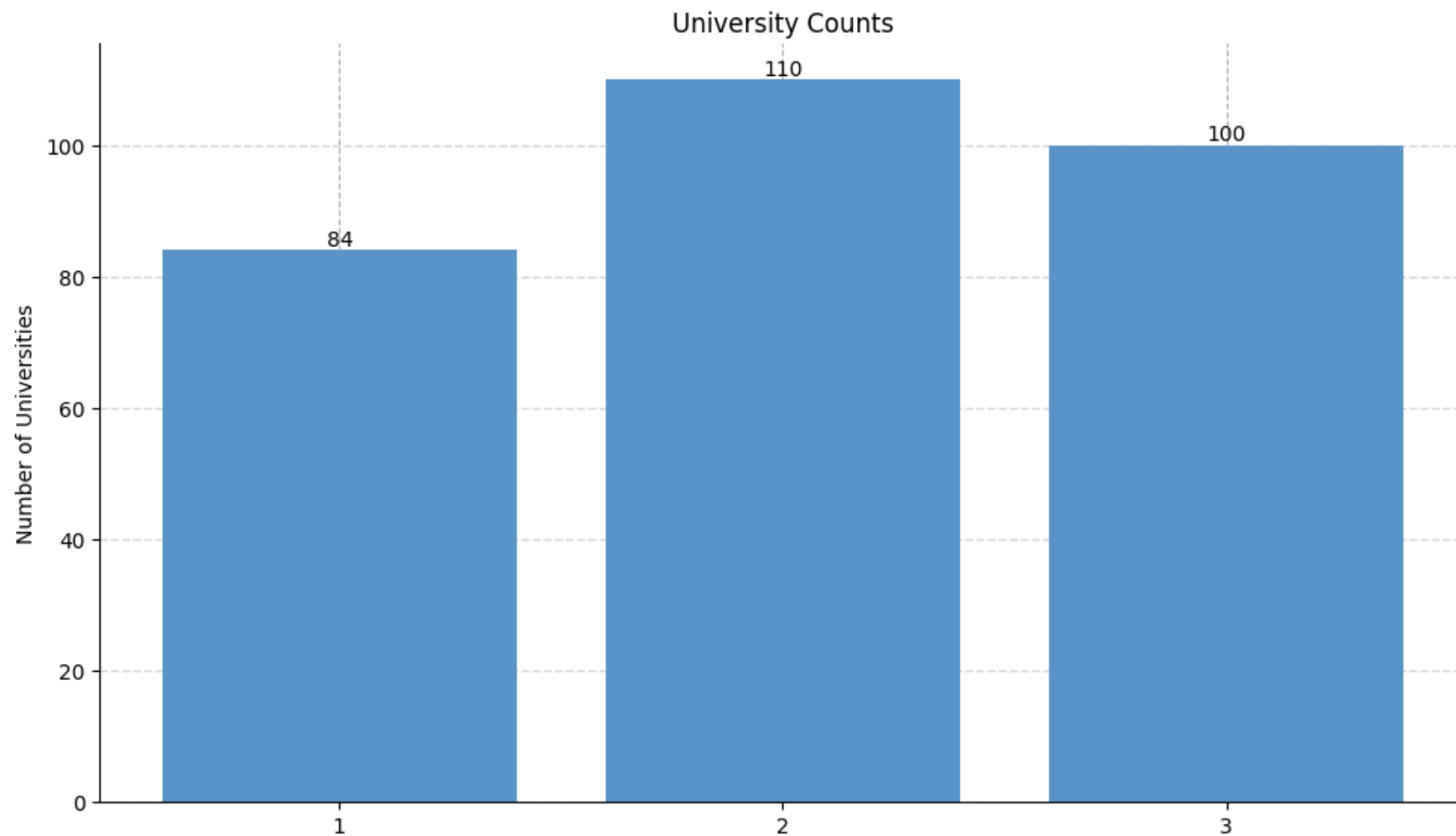
Dataset construction and preprocessing

Data analysis

Courses + Degrees + AI contents

Gap identification and Recommendations

# Results



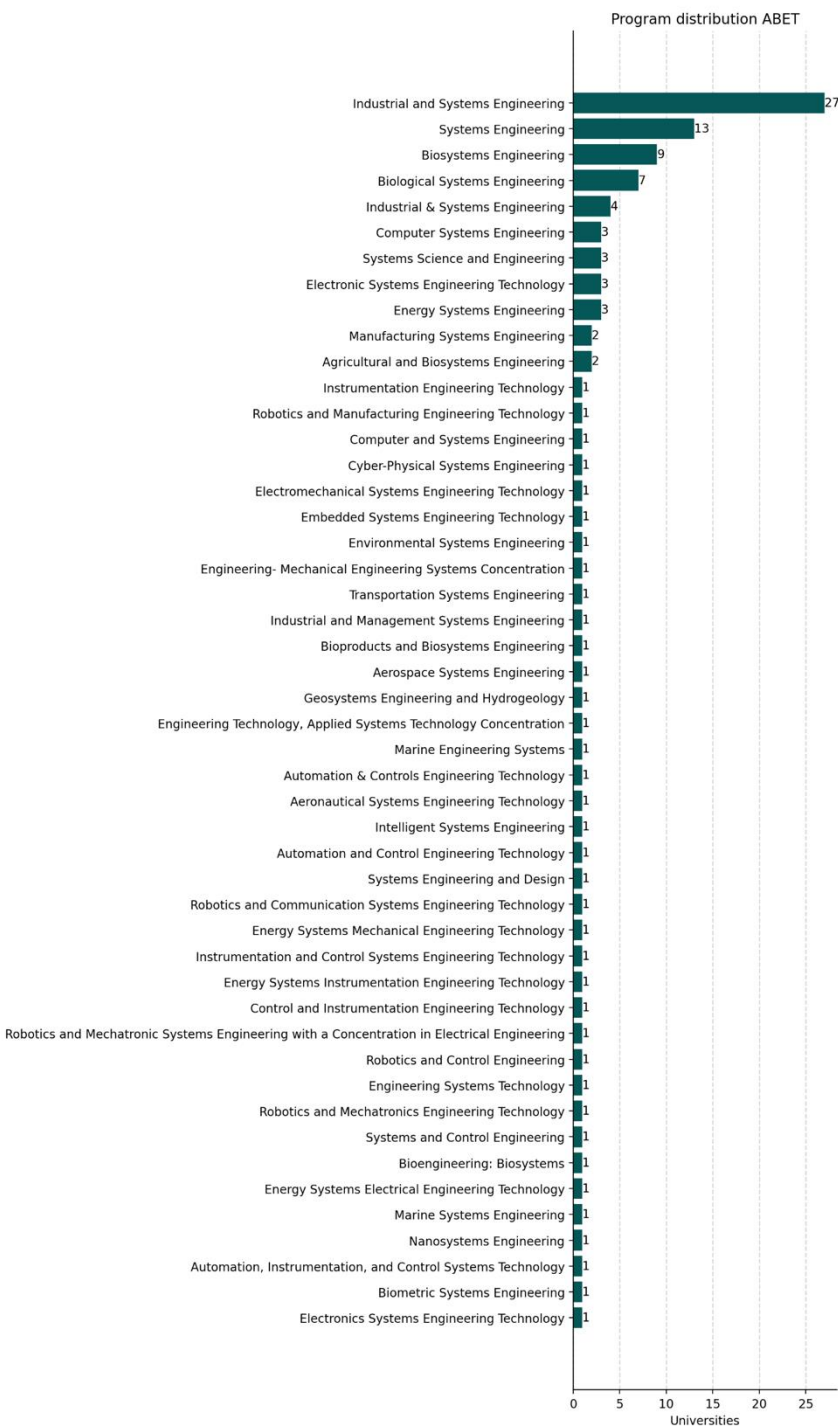
Note:

1 = Universities that have Systems Engineering

2 = Universities that have ABET accreditation on Systems Engineering

3 = Universities that have top 100 ranking in U.S. News in industrial / manufacturing / systems engineering

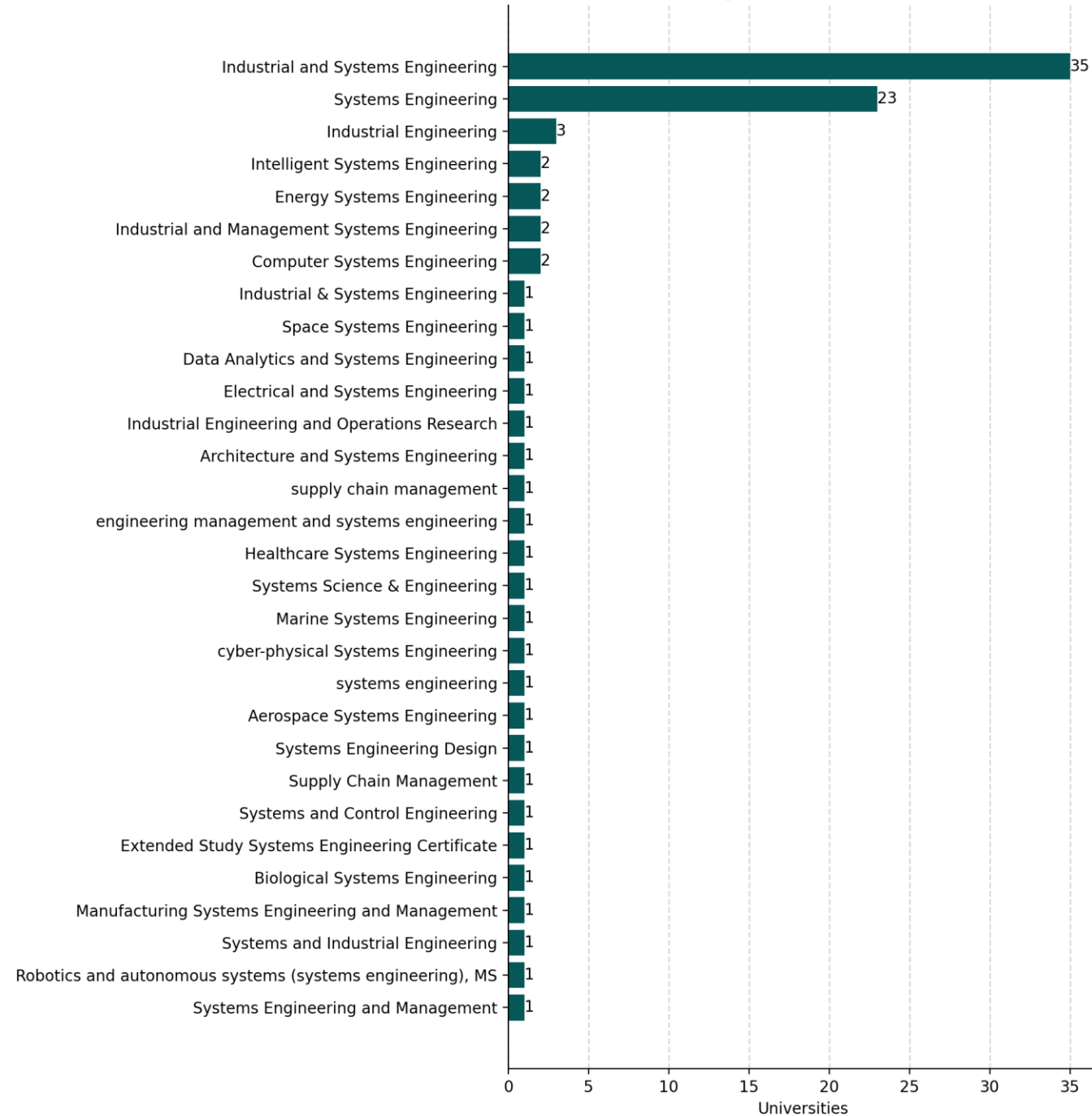




## • University Counts for ABET Programs in Systems Engineering (Broader Concept)

- Industrial and Systems Engineering — **27**
- Systems Engineering — **13**
- Biosystems Engineering — **9**
- Biological Systems Engineering — **7**
- Industrial & Systems Engineering — **4**
- Computer Systems Engineering — **3**
- Systems Science and Engineering — **3**
- Electronic Systems Engineering Technology — **3**
- Energy Systems Engineering — **3**
- Manufacturing Systems Engineering — **2**
- ...

Program distribution SE

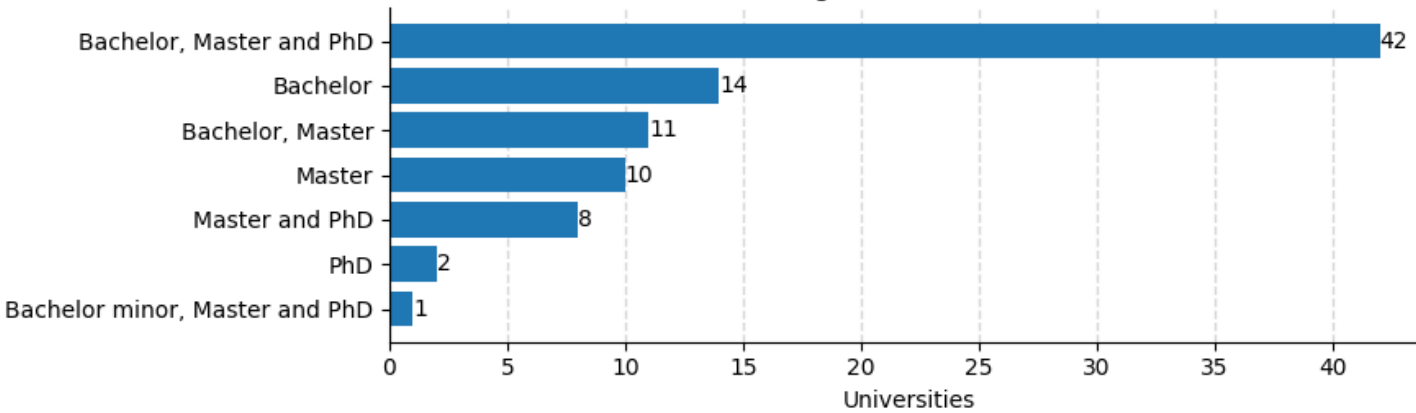


## - University Counts for Systems Engineering (Narrowed Concept)

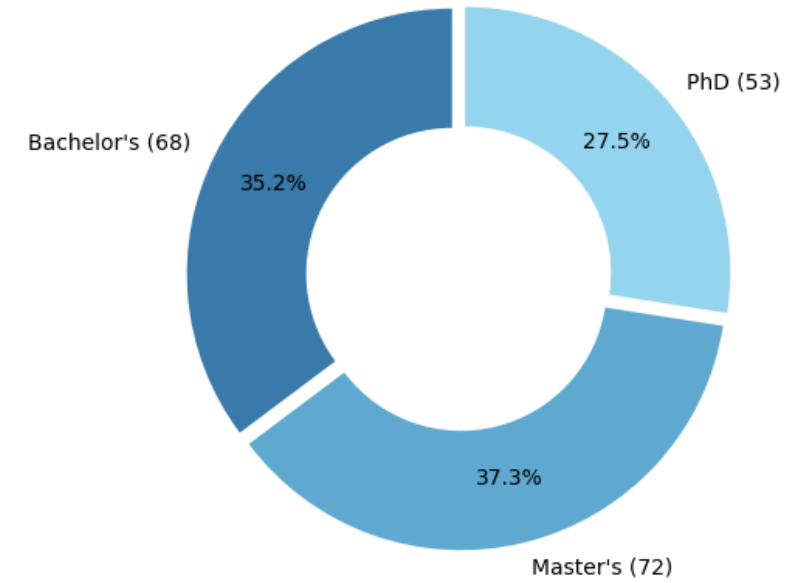


# Results

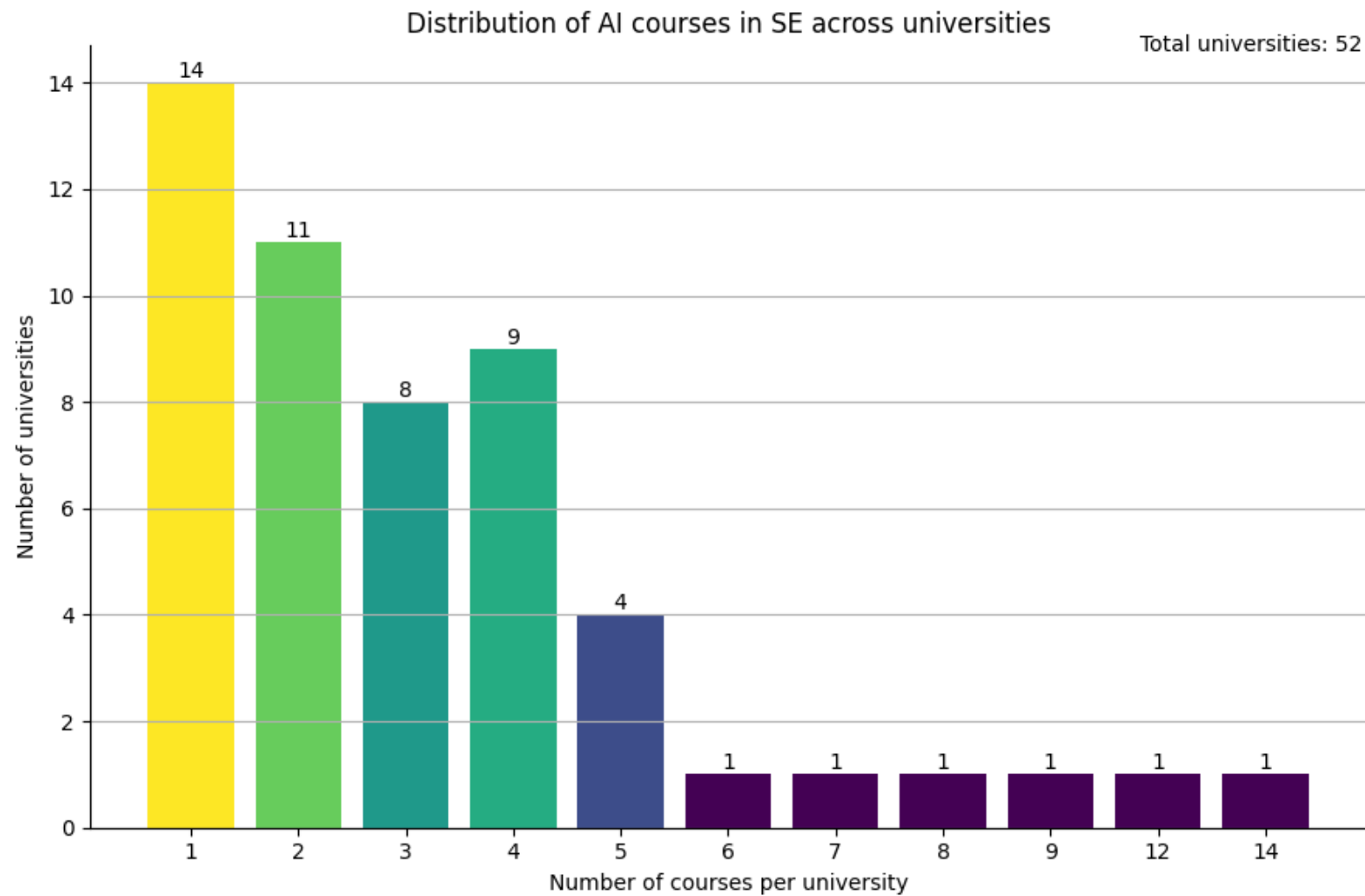
Degree Distribution



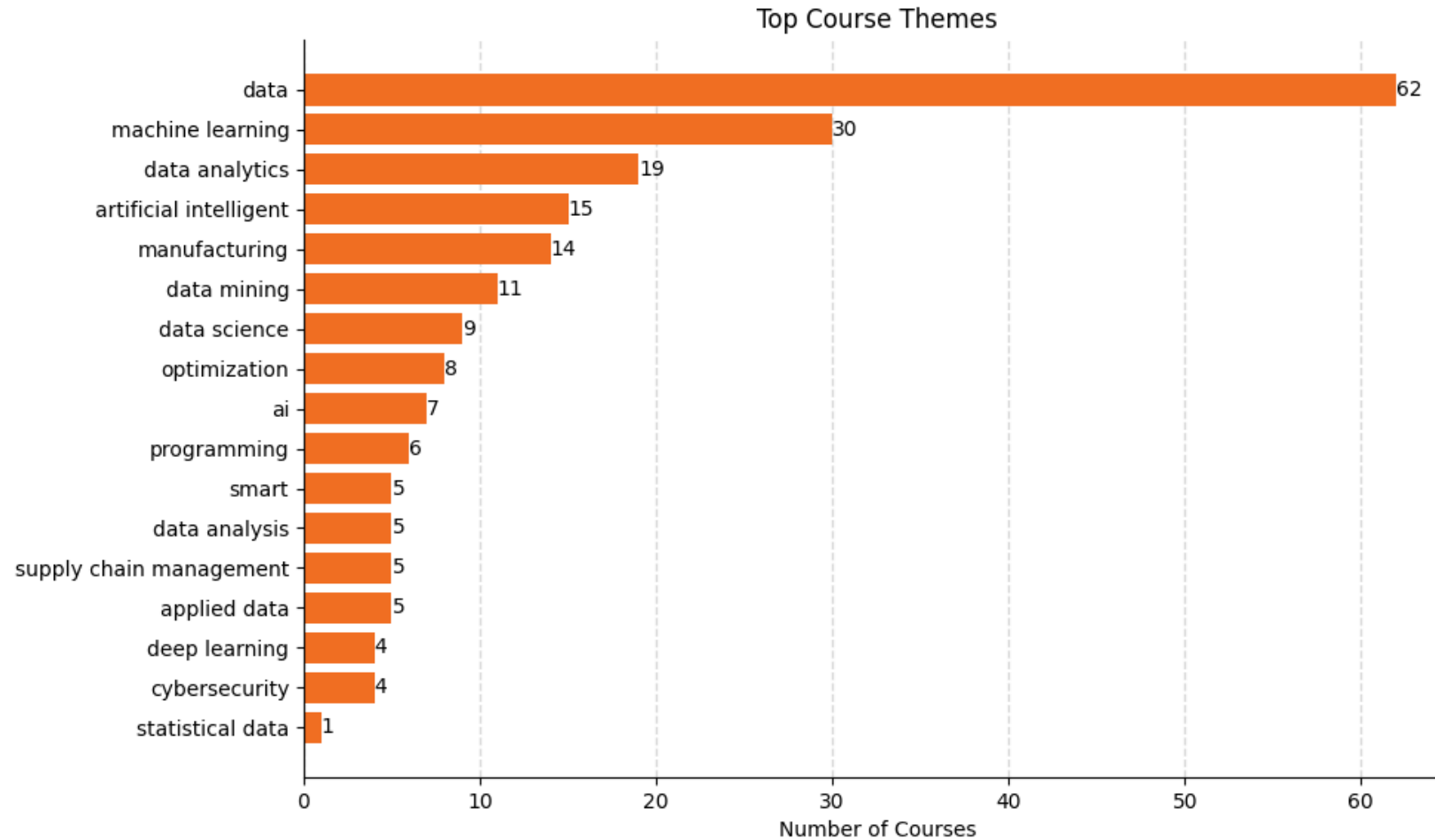
Universities Offering Bachelor's, Master's, and PhD



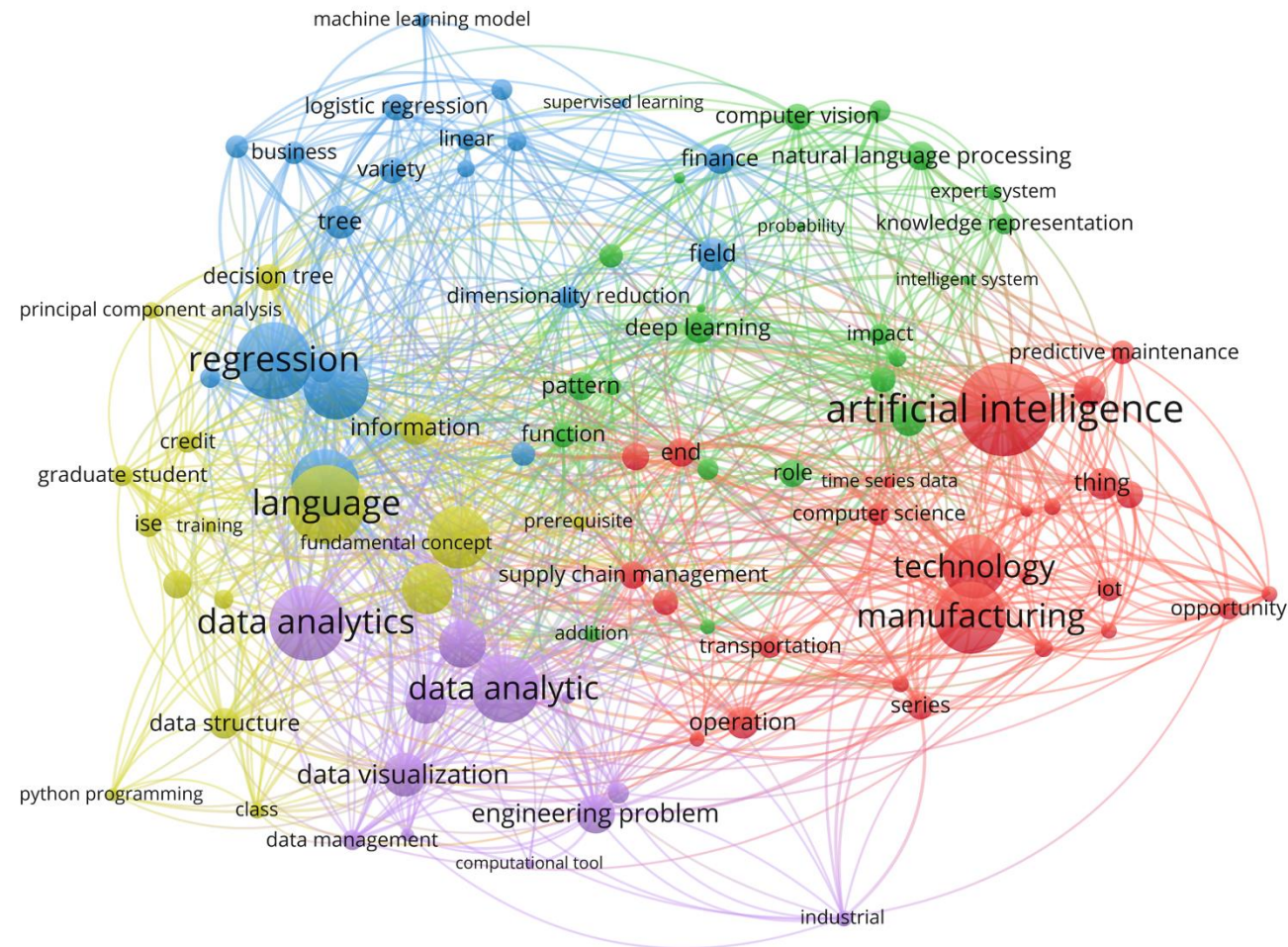
# Results



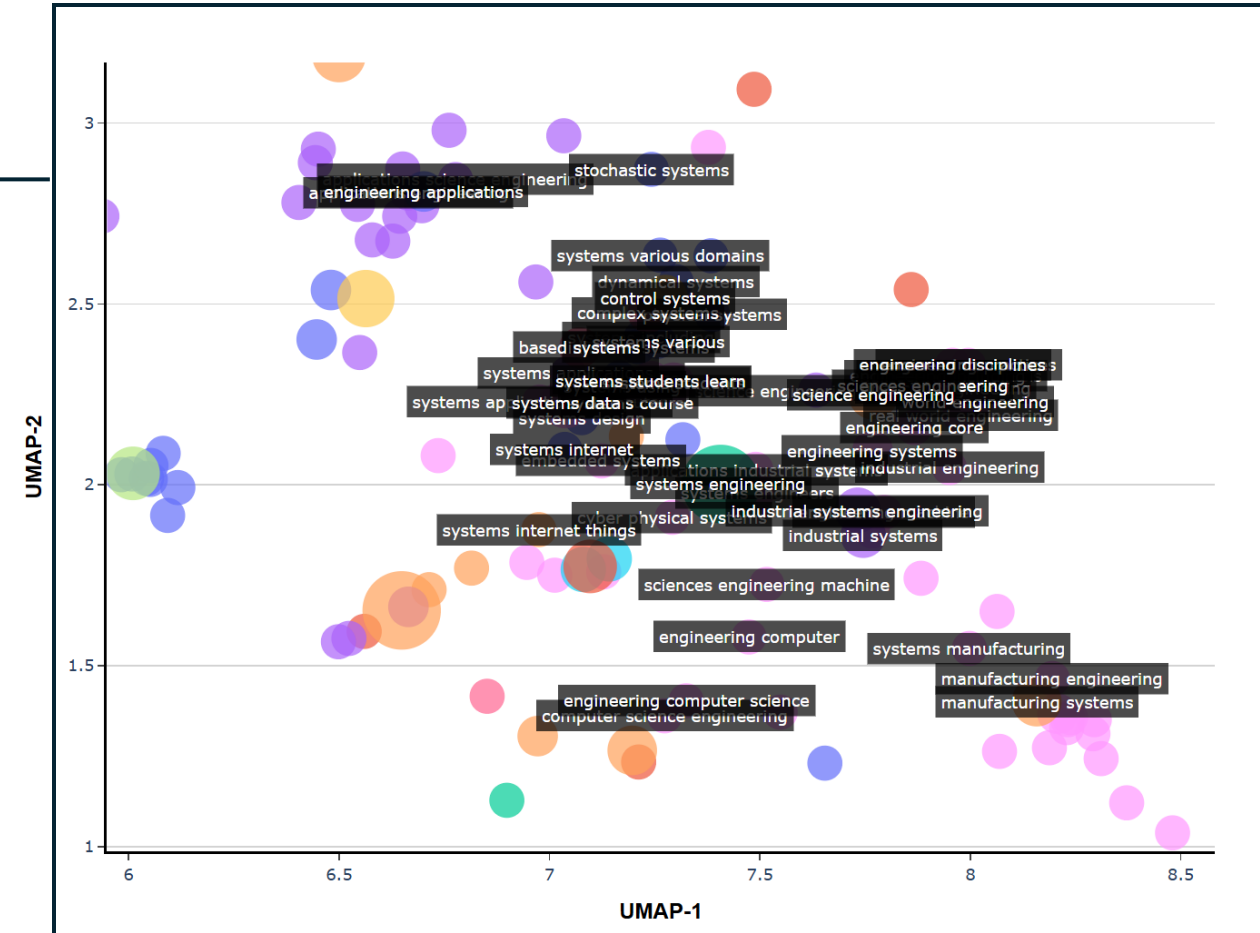
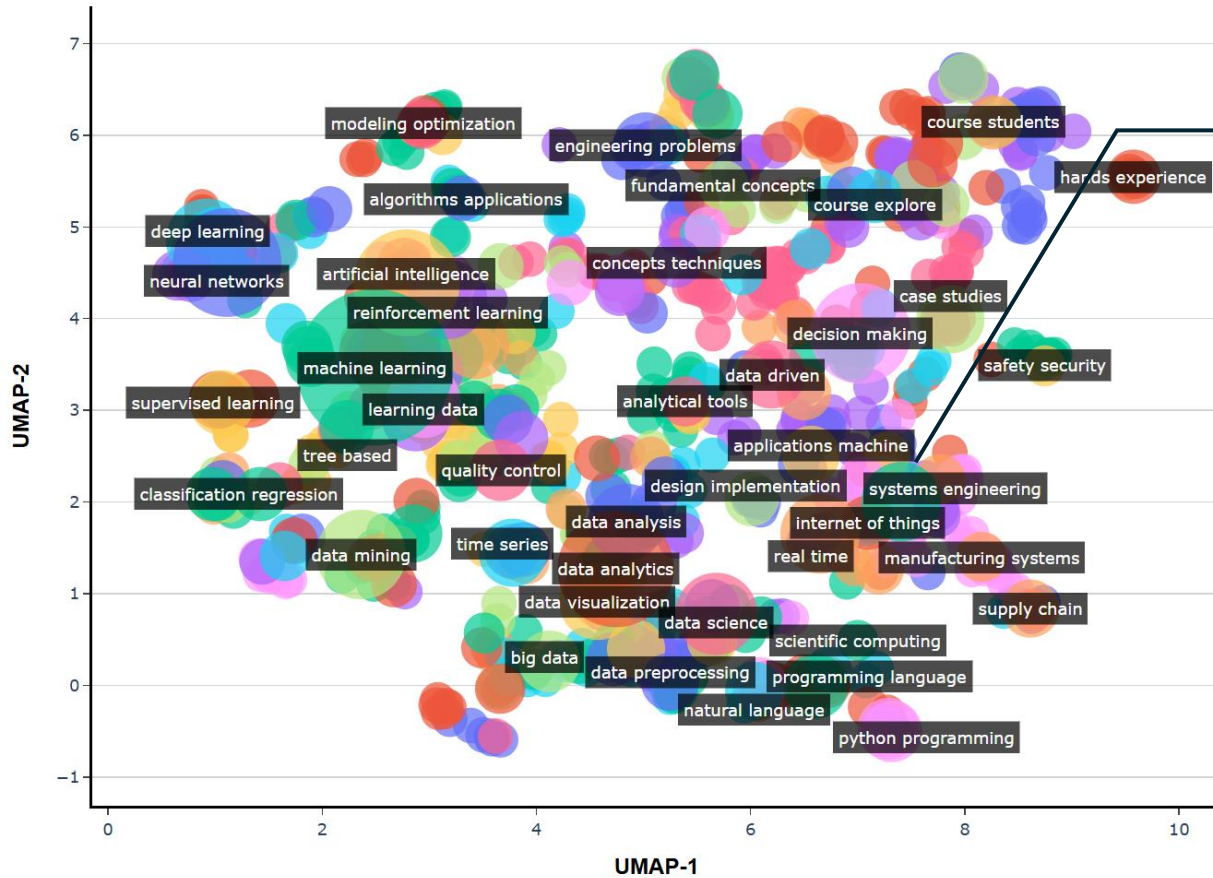
# Results



# Results – Key Words Relationships



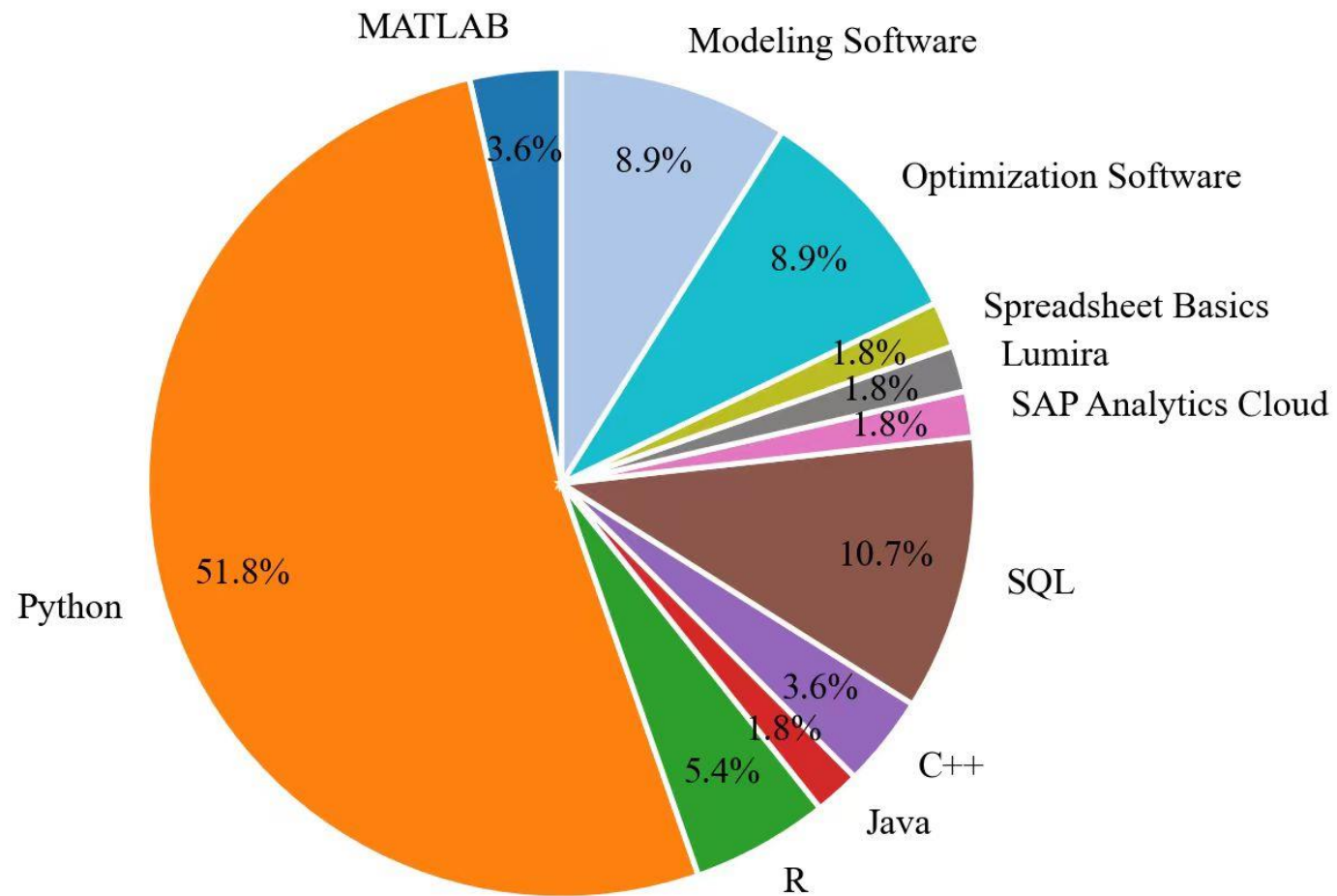
# Results - UMAP





# Results

Software used in courses for AI in SE





# Recommendation

Core Courses	Topics
AI Foundations for Systems Engineers (Grad/UG+)	supervised/unsupervised ML, deep learning basics, feature engineering, time-series
Data Analytics & Visualization for SE	classification, clustering, decision analysis
Optimization & ML Integration	operations research, predict-then-optimize, differentiable optimization
AI Integration in Systems Engineering Courses	Topics
MBSE for AI-Enabled Systems	SysML, equiement flows, interfaces for ML subsystems, V&V strategies
AI for Industrial & Manufacturing Systems	predictive maintenance, anomaly detection, vision QA, IoT pipelines, time-series
AI for Supply Chain & Resilience	demand forecasting, network design under uncertainty, RL for fulfillment, risk & resilience
Advanced AI courses	Topics
Digital Twins & Simulation with AI-in-the-Loop	hybrid modeling (physics+ML), calibration, scenario testing; RL in simulators
Human-System Integration, NLP & Decision Support	NLP for requirements/incident logs, retrieval-augmented decision aids, explainability

# Conclusions and Limitations

1. We identify **52 representative universities** that currently offer AI-in-Systems-Engineering (AI-in-SE) courses and/or training programs.
2. AI content has been **introduced broadly**, but much of it remains **AI-centric** rather than embedded within systems engineering.
3. Future curricula should **prioritize AI integration** into SE practice
4. Findings are constrained by **variation in universities' research activity and transparency**, potential **selection bias** in available materials, and **temporal drift** as curricula evolve—so results reflect a best available snapshot rather than an exhaustive census.

# THANK YOU!

