Offering Data Science Coursework to Non-Computing Majors

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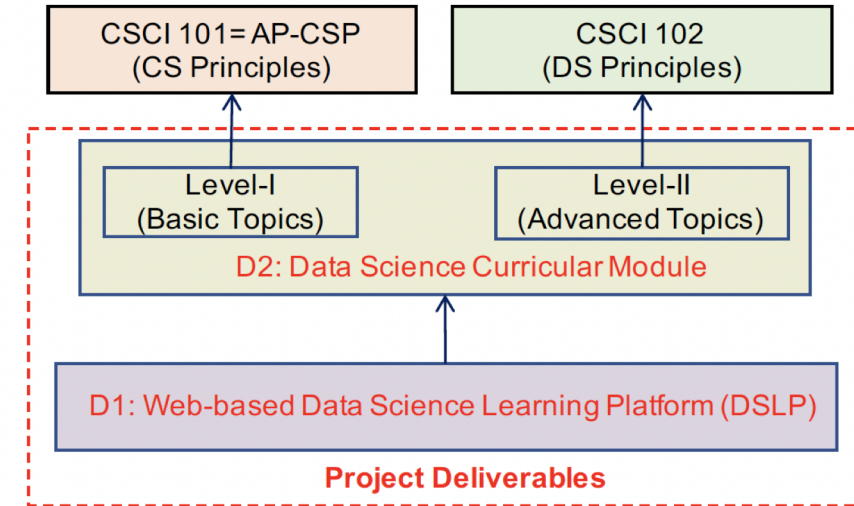
University of Rochester

RIT

Agenda

- **Data Science coursework for Non-Computing Majors**
- **Quick definition of Data Science**
- **Challenges of teaching DS topics to Non-Computing Majors**
- **Principles of Data Science course organization**
- **Student feedback**
- **Get involved!**

DS Coursework for Non-Computing Majors

- ISCH-110 (Principles of Computing)
  - Duration for the course module: 1 week (3 hours)
- ISCH-370 (Principles of Data Science)
  - Duration: 14 weeks

- Both ISCH-110 and ISCH-370 are core courses in the Principles of Computing Immersion curriculum at RIT, offered to non-computing majors

- Project website: https://cs.rit.edu/~xl/IUSE.html

CSCI 101=AP-CSP (CS Principles)

CSCI 102 (DS Principles)

Level-I (Basic Topics)

Level-II (Advanced Topics)

D2: Data Science Curricular Module

D1: Web-based Data Science Learning Platform (DSLP)

Project Deliverables

Agenda
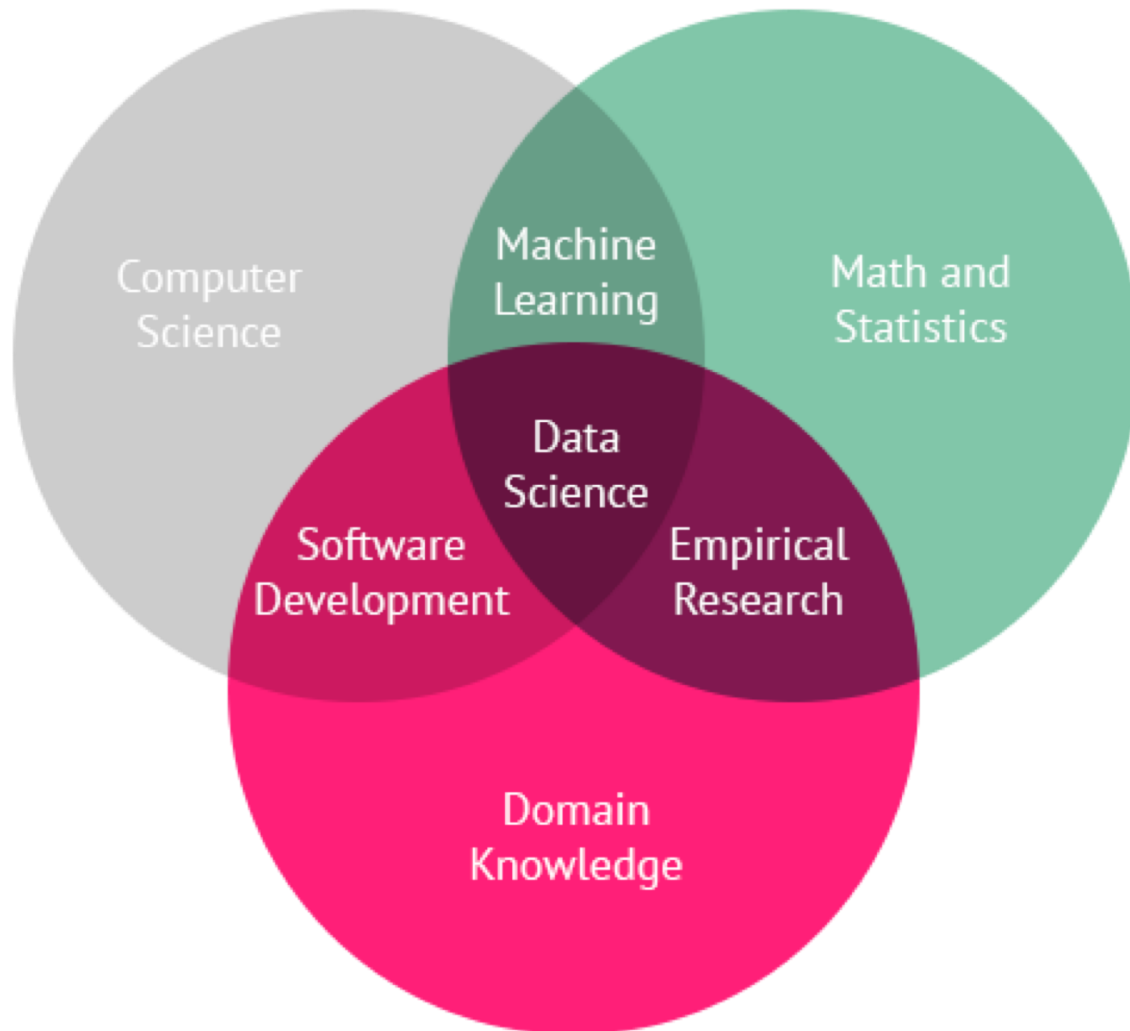
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Data to Knowledge Pipeline
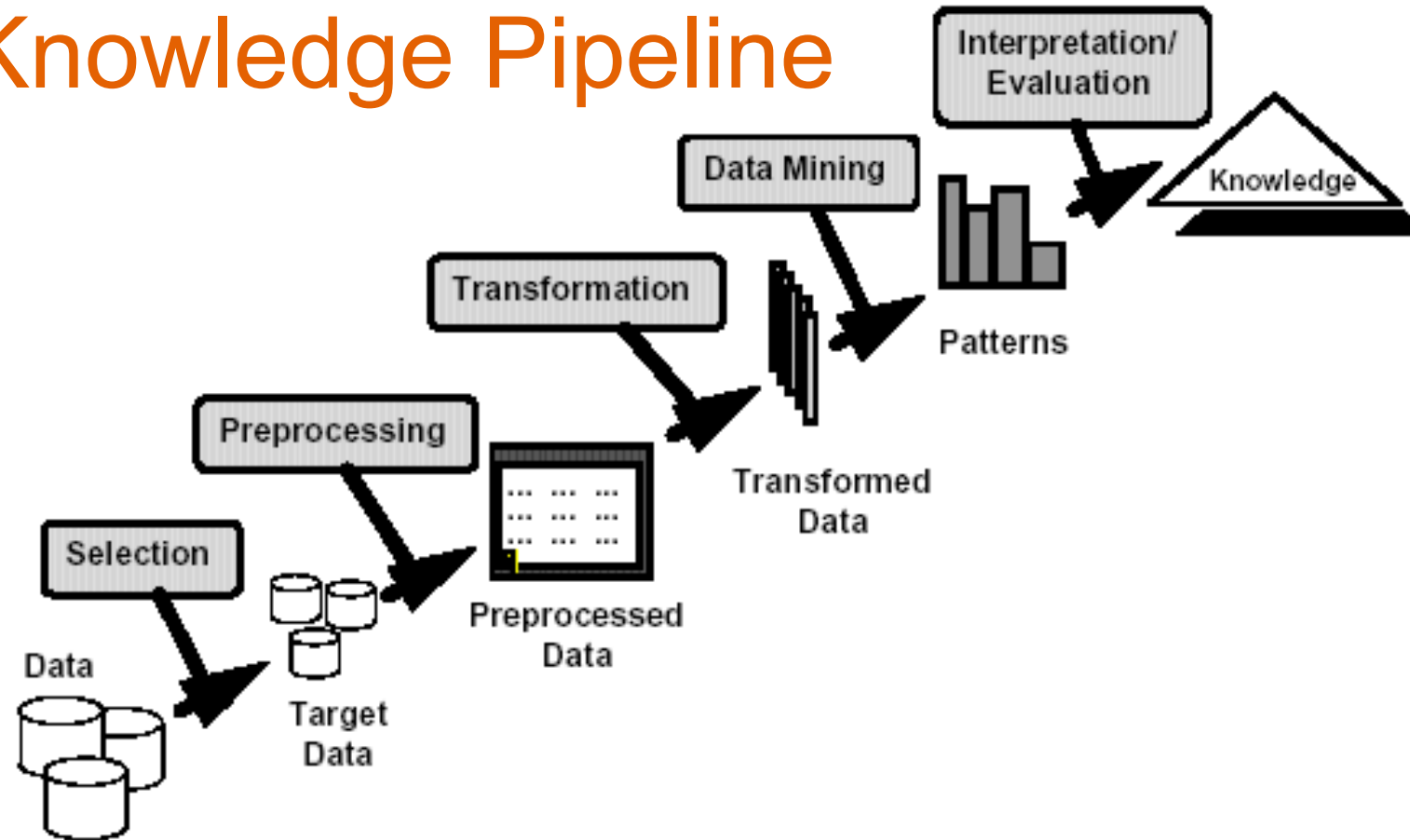
Data science is an interdisciplinary field that uses **scientific** methods, processes, algorithms and systems to extract knowledge and insights from structured and unstructured **data**, and apply knowledge and actionable insights from **data** across a broad range of application domains.

Data Science Venn Diagram

Examples of Majors
Film Production
Communication
Management Information Systems
Political Science
Electrical Engineering
History (required course for these students)

| Programming Experience (self-assessed) |
|---|
| None: 4% |
| Informal experiences **before** college: 36% |
| Informal experiences **during** college: 40% |

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Teaching Challenges

- Achieve desirable learning outcomes
  - Non-computing majors are unlikely to have the "necessary" coding and statistics background

- Solve problems in various domains
  - Need to engage non-computing majors by using data from a variety of domains

- Set up accessible lab environments
  - Even computing majors have a difficult time properly configuring tools for data science courses!

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Addressing Teaching Challenges

- Achieve desirable learning outcomes
  - Goal-oriented in-class Python coding examples. Teach "just enough" statistics while avoiding unnecessary details. Heavy use of hands-on exercises!

- Solve problems in various domains
  - Hands-on exercises draw datasets from a variety of domains. Students choose their own datasets for the course project.

- Set up accessible lab environments
  - Use Google Colab for Python coding exercises. Developed a web-based Data Science Learning Platform (DSLP) for hands-on exercises.

Data Science Learning Platform

Course Organization

Data Preprocessing Topics (First half of course)	Data Mining Topics (Second half of course)
Data Cleaning	Classification
Data Exploration and Visualization	Regression
Feature Selection	Clustering
Feature Engineering	**Interpretation of Data Mining results**

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End of Course Survey Results (Lectures)

Question	Positive	Neutral	Negative
Lectures were easy to follow	56%	24%	20%
Lectures improved understanding	64%	32%	4%
Lectures increased my interest in Data Science	40%	36%	24%
I can perform similar Data Science tasks to those in lecture	63%	33%	4%

End of Course Survey Results (Exercises)

DSLP

Question	Positive	Neutral	Negative
Exercises were easy to follow	**84%**	**8%**	**8%**
Exercises improved understanding	68%	24%	8%
Exercises increased my interest in Data Science	44%	40%	16%
I can perform similar Data Science tasks to those in exercise	68%	24%	8%

Google CoLab

Question	Positive	Neutral	Negative
Exercises were easy to follow	**60%**	**32%**	**8%**
Exercises improved understanding	68%	24%	8%
Exercises increased my interest in Data Science	48%	32%	20%
I can perform similar Data Science tasks to those in exercise	68%	24%	8%

Key Takeaways

- This group of non-computing majors appear interested in Data Science topics and indicate an interest in continuing their learning (**72% stated they were likely to take another course in Data Science**)

- These non-computing majors appear to learn best from hands-on exercises with minimal or no coding components via the Data Science Learning Platform (**In spite of bugs in the platform!**)

- Our students are enthusiastic about choosing their own datasets for their projects, but do get frustrated with their limited coding capabilities (**When met with these challenges, students were encouraged to use other tools they already know, such as Excel**)

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Want to get involved?

- Please contact Xumin Liu (xmlics@rit.edu) or Erik Golen efgics@rit.edu if you would like to have access to the teaching materials and/or the Data Science Learning Platform (DSLP).

- Teaching materials:
  - Lecture slides
  - In-class coding demos
  - Python and DSLP exercises (with keys)
  - Quizzes/Exams (with keys)

- Access to DSLP:
  - Register accounts (students and instructors) on the current server
  - Host and manage the platform at your institution