

CEN 5016: Software Engineering

Spring 2026



University of
Central Florida

Dr. Kevin Moran

Week 8 - Class 1:
Introduction to Software
Engineering Research
+
How to Read a Research Paper





- *Guest Academic + Industry Speaker Next Week!*
- *Assignment 4 will be released tomorrow.*
 - Due date extended to next week
- *Feedback for SDE Project coming today/tomorrow*
 - I am extending the SDE project by one week - until *March 13th*
- *Exams will be graded and posted by Friday*
 - All grades will be current by Weds next week
- *Research Paper Presentation Selection*
 - *Due by end of next week - more details on Monday*

Software Engineering

Software Engineering

The methods and techniques by which developers design, create, test, and manage software

Software Engineering

The methods and techniques by which developers design, create, test, and manage software

Research Goal: Design tailored *automated approaches* to help facilitate *developer needs* throughout the software development and maintenance lifecycle.

PRACTICAL SIGNIFICANCE

PRACTICAL SIGNIFICANCE

Blend *scientific discovery* with *practical significance*

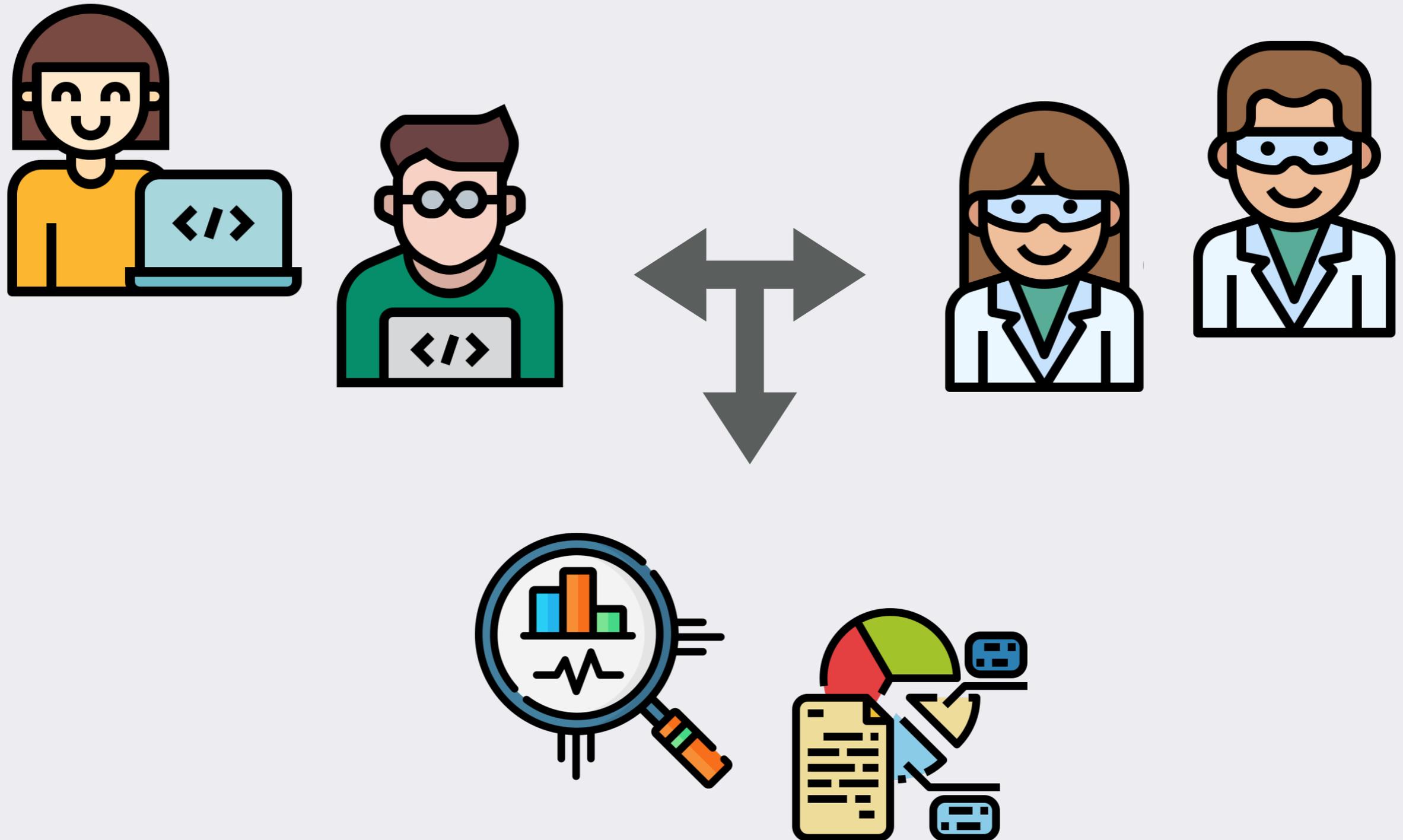
PRACTICAL SIGNIFICANCE

Blend *scientific discovery* with *practical significance*



How Can We Design Practical Automation?

UNDERSTANDING DEVELOPER NEEDS



MINING SOFTWARE REPOSITORIES

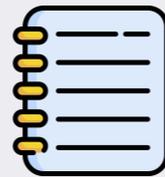


MINING SOFTWARE REPOSITORIES

MINING SOFTWARE REPOSITORIES



Source Code
Files



Software
Documentation



Screenshots



Screen
Recordings

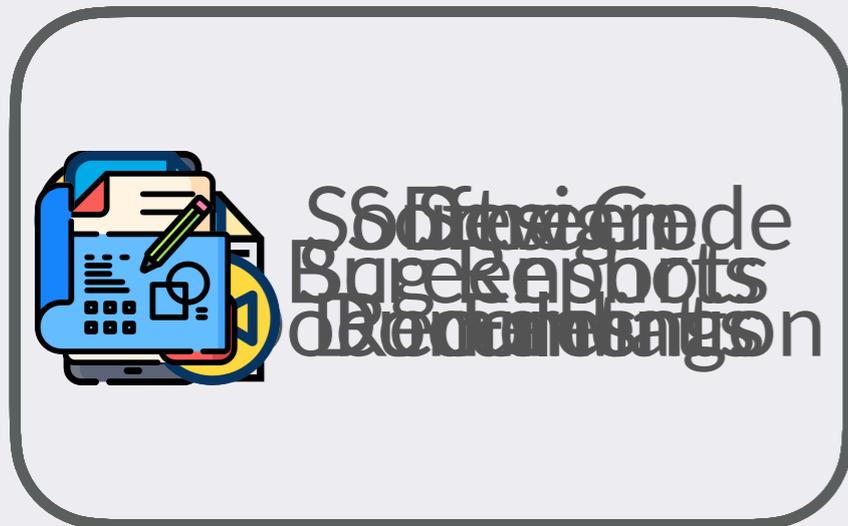


Bug Reports



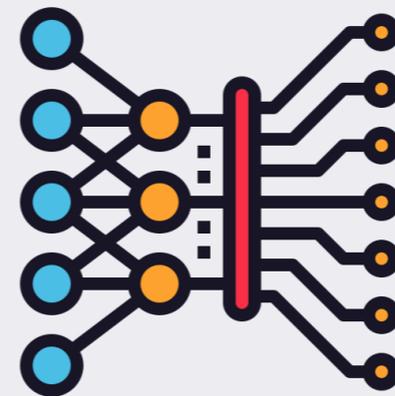
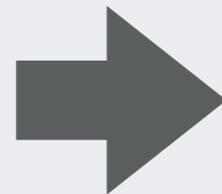
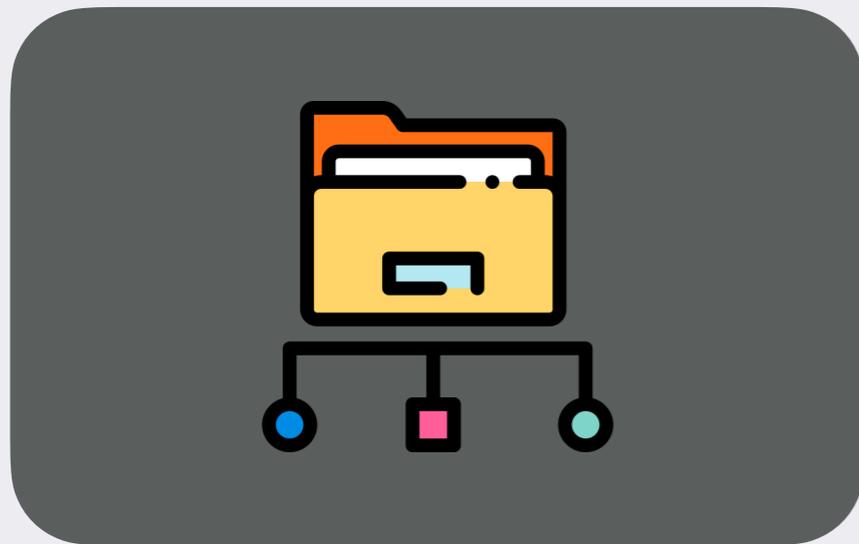
Design
Documents

LEARNING PATTERNS FROM SOFTWARE DATA

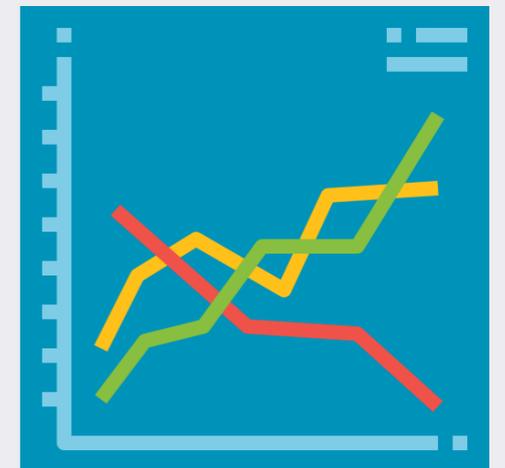
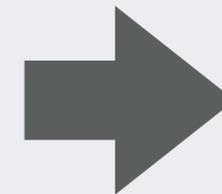


LEARNING PATTERNS FROM SOFTWARE DATA

Software
Repository Data

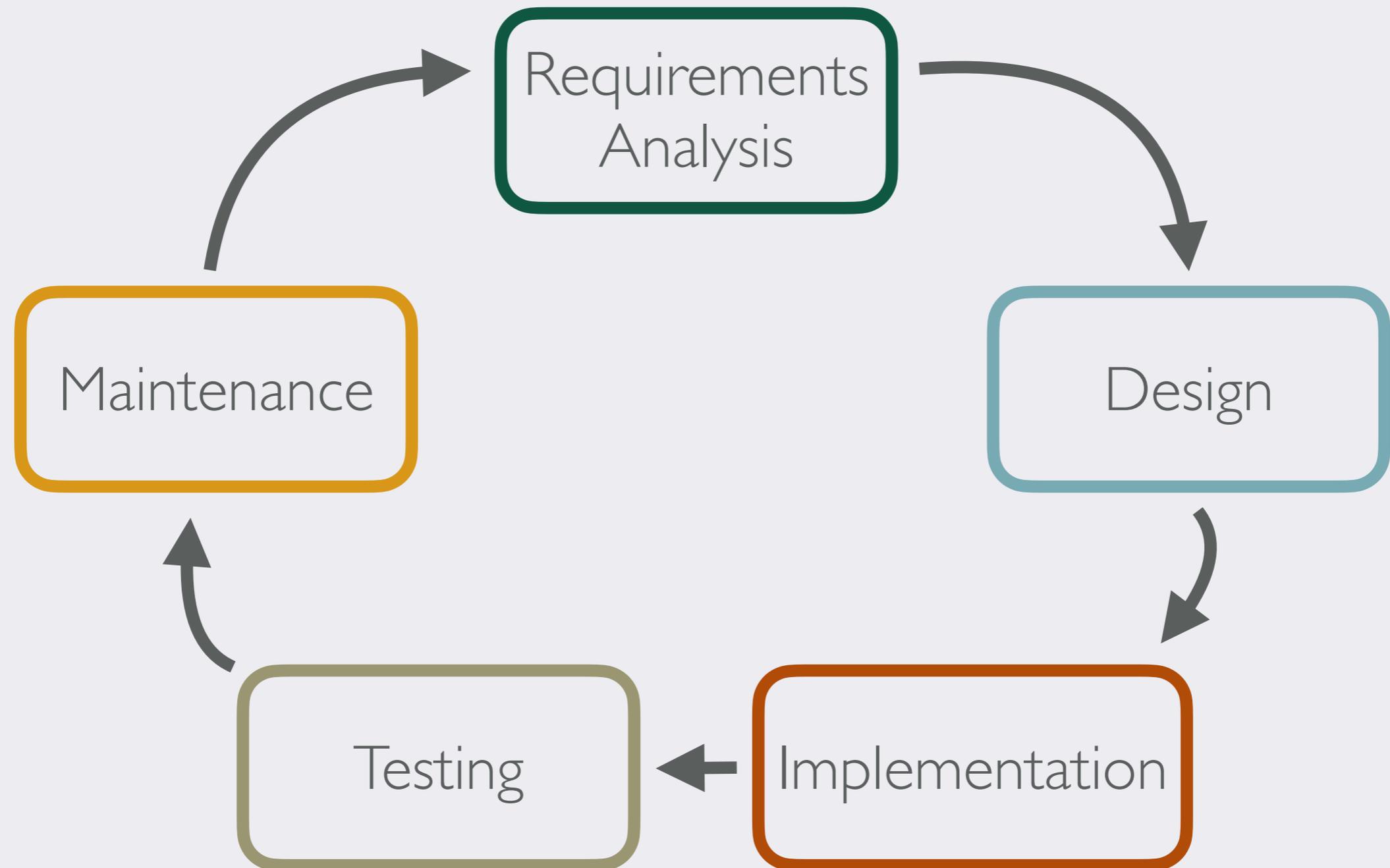


Machine
Learning



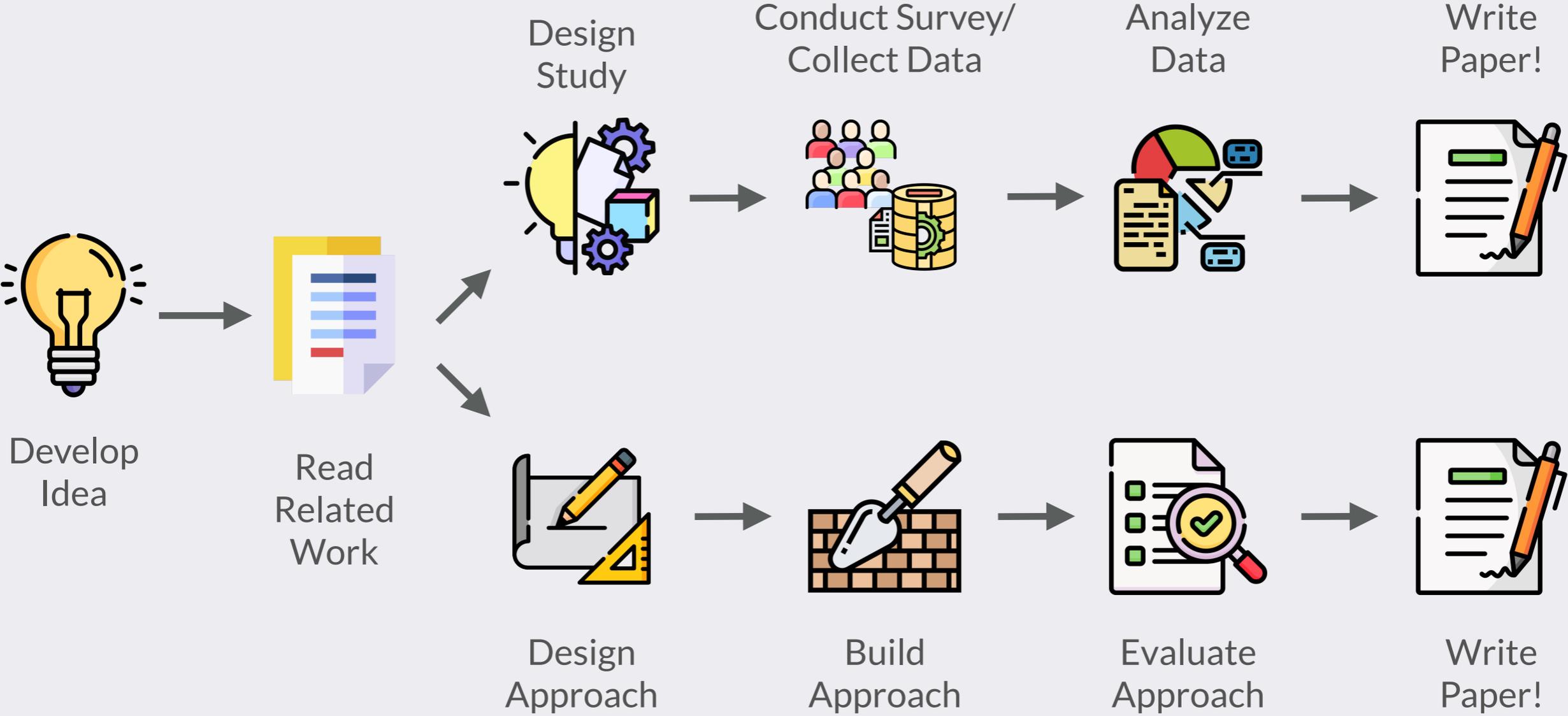
Salient
Patterns

SOFTWARE DEVELOPMENT LIFECYCLE



HOW SOFTWARE ENGINEERING RESEARCH WORKS

SE RESEARCH PROJECT ROADMAP



TYPICAL SE RESEARCH TOPICS

AI and software engineering:

- Search-based software engineering
- Machine learning with and for SE
- Recommender systems
- Autonomic systems and self adaptation
- Program synthesis
- Program repair

Testing and analysis:

- Software testing
- Program analysis
- Debugging and Fault localization
- Programming languages
- Performance
- Mobile applications

Software analytics:

- Mining software repositories
- Apps and app store analysis
- Software ecosystems
- Configuration management
- Software visualization

Dependability:

- Formal methods
- Validation and Verification
- Reliability and Safety
- Privacy and Security
- Embedded and cyber-physical systems

Software evolution:

- Evolution and maintenance
- API design and evolution
- Release engineering and DevOps
- Software reuse
- Refactoring
- Program comprehension
- Reverse engineering

Social aspects of software engineering:

- Human aspects of software engineering
- Human-computer interaction
- Distributed and collaborative software engineering
- Agile methods and software processes
- Software economics
- Crowd-based software engineering
- Ethics in software engineering
- Green and sustainable technologies

Requirements, modeling, and design:

- Requirements Engineering
- Privacy and Security by Design
- Modeling and Model-Driven Engineering
- Software Architecture and Design
- Variability and product lines
- Software services

SE RESEARCH VENUES

Conferences

International Conference on
Software Engineering (ICSE)

Symposium on the Foundations
of Software Engineering (FSE)

International Conference on
Automated Software Engineering (ASE)

International Conference on Software
Maintenance & Evolution (ICSME)

International Conference on Mining
Software Repositories (MSR)

International Symposium on Software
Testing and Analysis (ISSTA)

Journals

IEEE Transactions on
Software Engineering

ACM Transactions on
Software Engineering
& Methodology

Springer Empirical
Software Engineering

How to Read a Research Paper





- Adapted from William G. Griswold's advice on "How to Read an Engineering Research Paper"
- <http://www-cse.ucsd.edu/~wgg/CSE210/howtoread.html>

Before Reading a Research Paper



- Reading research papers effectively is challenging
- Why?
- Condensed style, focused audience, paper organization
- To effectively read papers you should know:
 - What you should get out of the paper?
 - Where that information is located?

How a Research Paper is Organized



- Technical papers are repetitive in nature!
- Introduction = motivation + solution outline
- Related Work
- Body of the Paper
 - Details on the solution
 - Detailed evaluation
- Discussion of the results
- Conclusions (recap of contributions and results)
- Because of these repetitions, you can read the paper ‘out of order’



- What are the motivations for this work?
 - A published paper solves the problem and no one else has published in the literature
 - Why there is no trivial solution to this problem?
 - What are the previous solutions and why are they inadequate?
- Specific research questions?
 - Motivation and statement should lead to this
 - This does not always happen – your job is a bit more difficult in that case



- *What is the proposed solution?*
 - Hypothesis (until it has been evaluated) or idea
 - Why is this solution better than previous solutions?
 - How the solution is achieved (design, implementation)?
 - Is it achievable at all? To what extent?



- *What is the work's evaluation of the proposed solution?*
 - Just having an idea is not sufficient anymore (although it used to be many years ago ...)
 - This is a concrete engagement of the research question (e.g., numbers)
 - Under which circumstances does it work (e.g., numbers) ?
 - What benefits and problems are identified?



- *What is your analysis of the identified problem, idea and evaluation?* (remember paper reports and subjective evaluation ...)
- Is this a good idea?
- What flaws do you perceive in this work?
- What are the most interesting points?
- What are the most controversial ideas or points?
- Is it really going to work?
- When might it become a reality?



- What are the contributions:
 - A new understanding of a research problem?
 - A new methodology for solving a problem?
 - A new algorithm?
 - A new breed of software tools or systems?
 - A new experimental method?
 - A new formalism or notation?
 - A new evidence to substantiate or disprove a previously published claim?
 - A new research area?



- *What are the future directions for this research*
- What do authors identify as a future work?
- What ideas did you come up with while reading the paper?
- You may get answers to these questions from the analysis of shortcomings or other critiques in the current work



- *What is your take-away message from this paper?*
- Sum up the main implication of the paper from your perspective (e.g., from your class project's perspective)!
- This is also useful for quick review and writing your final project paper!
- It also focuses you to identify the essence of the work



- As you read/skim the paper, actively attempt to answer questions 1-7
- Get motivation from the intro
- Intro & conclusion – the solution and evaluation at a high level
- Body of the paper – all the meat
- Pay attention to the context – other papers that are presented in the class WILL be relevant (past or future work for some papers ...)



- Use this template: <http://www.cse.ucsd.edu/~wgg/CSE210/paperform.pdf>

Taking Notes on the Paper



- *Take Notes on the Paper!*
- Highlight important comments.
- Mark paragraphs: motivation, problem, idea/solution, evaluation, contributions
- Front of the paper: take away message
- Front of the paper: your key questions!
- Other questions are on the margins.
- Try to answer questions yourself. Use Wikipedia and Google (carefully!)