CEN 5016: Software Engineering

Fall 2025

University of Central Florida

Dr. Kevin Moran

Week 9 - Class 1: Introduction to Software Engineering Research

Administrivia

- *Guest Industry + External Speaker Next Week!*
- *Assignment 4 should be fixed! (finally)*
- *Feedback for Project coming today/tomorrow*
- *Exams will be graded by Tuesday*
- *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

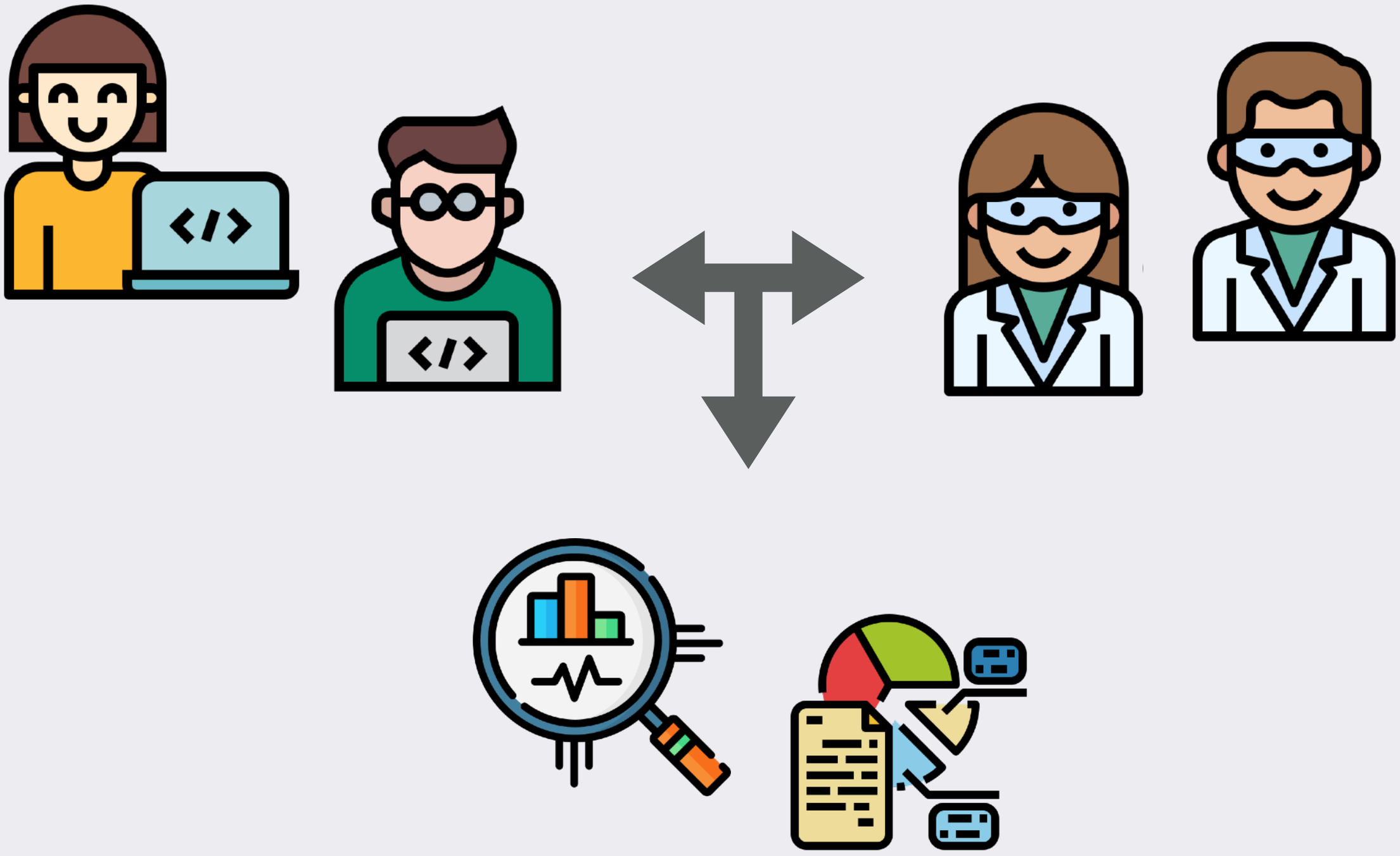
Blend *scientific discovery* with *practical significance*

Practical Significance

Blend *scientific discovery* with *practical significance*

How Can We Design Practical Automation?

Understanding Developer Needs



Mining Software Repositories

GitHub

Bitbucket

Google Play

SOURCEFORGE

GitLab

Mining Software Repositories

Mining Software Repositories

Source Code Files

Software Documentation

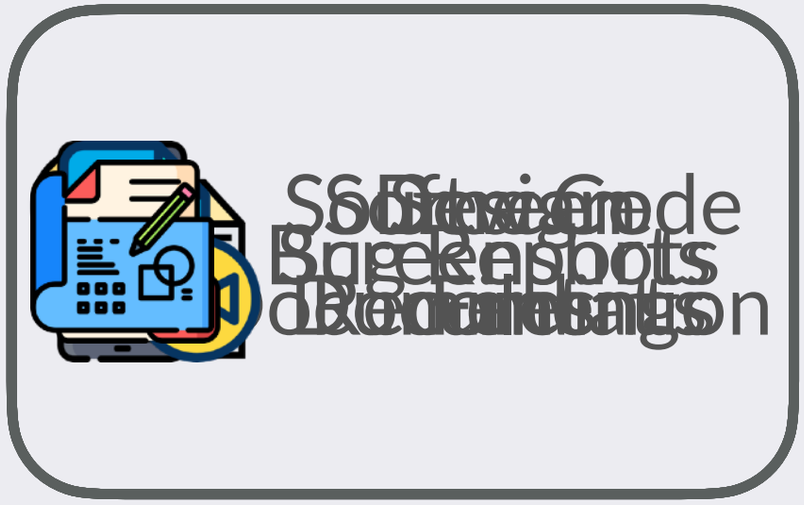
Screenshots

Screen Recordings

Bug Reports

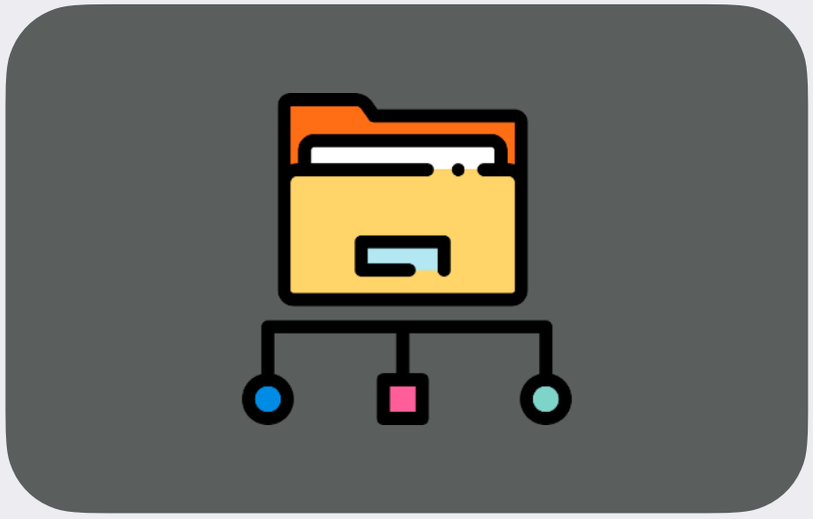
Design Documents

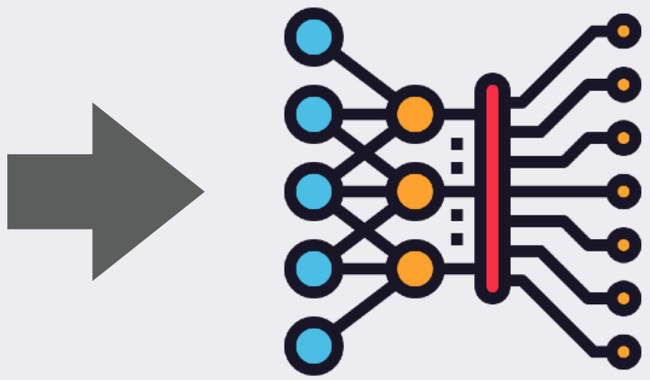
Learning Patterns from Software Data



Learning Patterns from Software Data

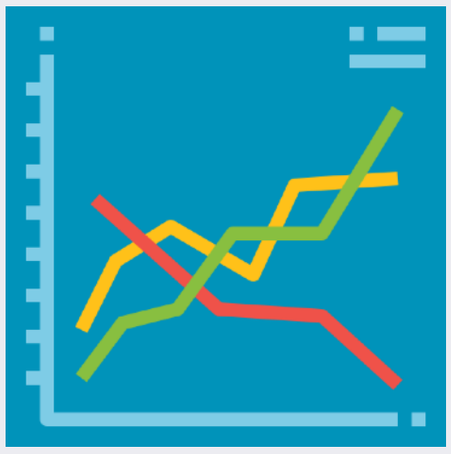
Software Repository Data



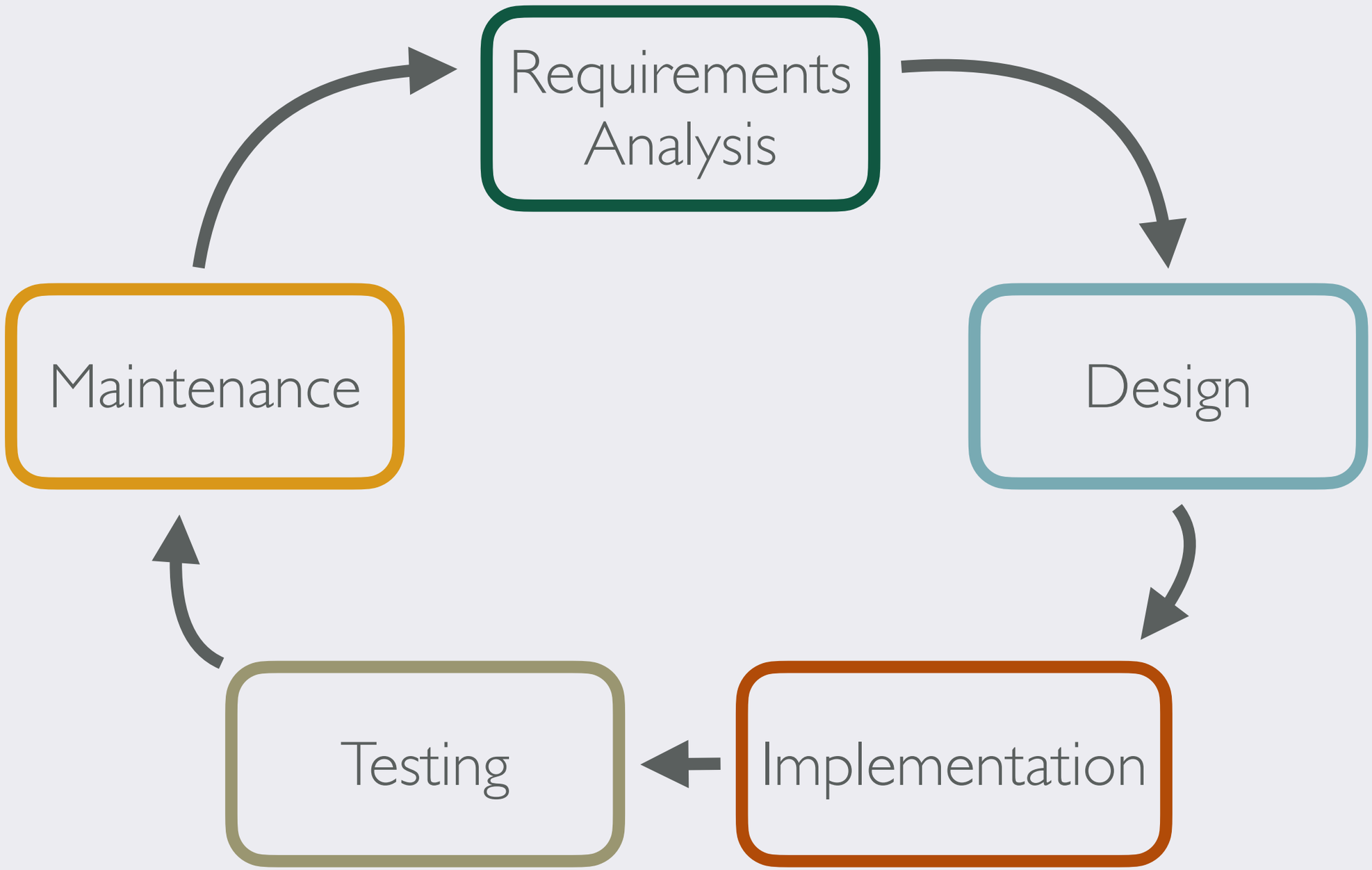


Machine Learning

Salient Patterns

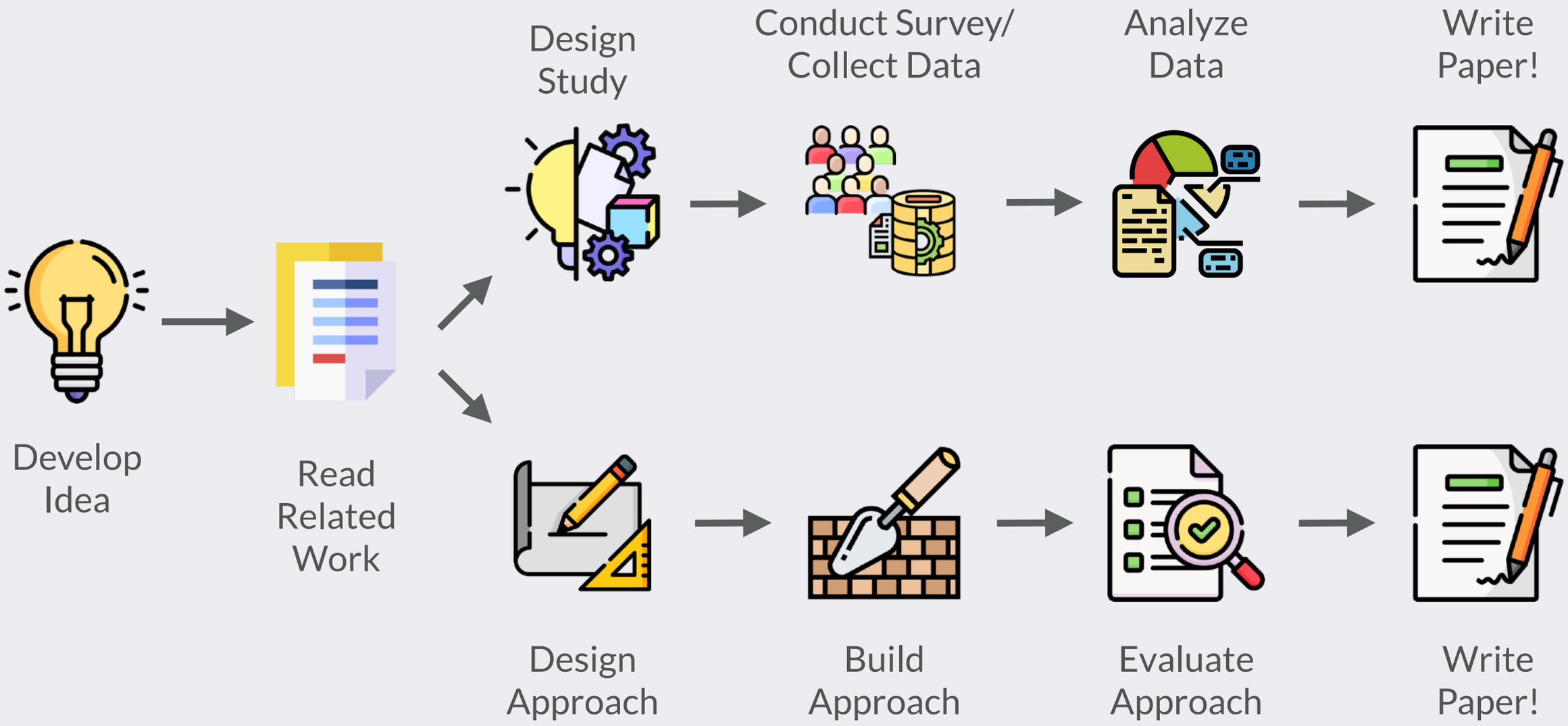


Software Development Lifecycle



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

CEN 5016:
Software Engineering

Fall 2025

University of
Central Florida

Dr. Kevin Moran

Week9 - Class 11:
How to Read and Present a Research Paper

Attribution

- 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’

Questions You Want to Answer - I

- *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

Questions You Want to Answer - 2

- *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?

Questions You Want to Answer - 3

- *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?

Questions You Want to Answer - 4

- *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?

Questions You Want to Answer - 5

- *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?

Questions You Want to Answer - 6

- *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

Questions You Want to Answer - 7

- *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

Mechanics

- 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 ...)

Paper Note Taking

- 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!)

CEN 5016: Software Engineering

Fall 2025

University of Central Florida

Dr. Kevin Moran

Week 9- Class 11: How to Present a Research Paper

Attribution

- Adapted from Simon Peyton Jones' presentation slides on "How to give a good research paper presentation"

Research is Communication

The greatest ideas are worthless if you keep them to yourself

- Your papers and talks
  - Crystalise your ideas
  - Communicate them to others
  - Get feedback
  - Build relationships
  - (And garner research brownie points)

Do it! Do it! Do it!

Good papers and talks are a fundamental part of research excellence

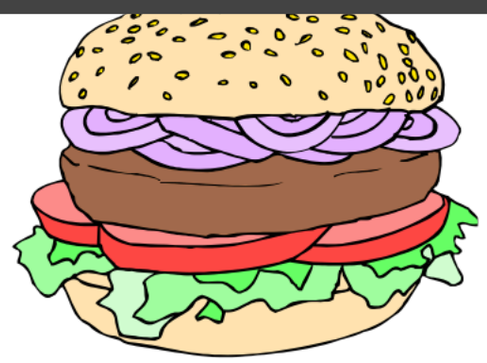
- Invest time
- Learn Skills
- Practice

Giving a Good Talk

- This presentation is about how to give a good research talk
  - What your talk is for
  - What to put in it (and what not to)
  - How to present it

What Your Talk is For

Your paper = **The beef**



Your talk = **The beef advertisement**

Do not confuse the two

The Purpose of Your Talk…

- …is not:
  - To impress your audience with your brainpower
  - To tell them all you know (or learnt) about the topic
  - To present all the technical details

The Purpose of Your Talk…

- …but is:
  - To give your audience an intuitive feel for “your” idea (i.e., explain the main idea of the paper)
  - To make them foam at the mouth with eagerness “to read your paper” (even though everybody should have read the paper for the class!)
  - To engage, excite, provoke them

Your Audience…

- The audience you would like:
  - Have read all the related papers (which you read while preparing your presentation)
  - Thoroughly understand all the relevant approaches to "traceability link recovery"
  - Are all eager to hear about the paper that you spent so much time preparing this presentation for
  - Are fresh, alert, and ready for action

Your ***Actual*** Audience…

- The audience you get:
  - Have heard of IFCMIC, ACMIC, OCMIC, FCMEC, DCMEC coupling measures, but wish they hadn't
  - Have just had lunch and are ready for a doze
- An instructor who read all the papers and even wrote some of them

Your mission is to

WAKE THEM UP!

and make them glad they did

What to put in

What to Put in the Talk

1. Motivation (20%)
2. The key idea (80%)
3. There is no 3

Motivation

- *You have 2 minutes to engage your audience before they start to doze*
  - Why should I tune into this talk?
  - What is the problem?
  - Why is it an interesting problem?

Example: Java class files are large (brief figures), and get sent over the network. Can we use language- aware compression to shrink them?

Example: Bug-tracking systems of large open source projects receive numerous duplicate bug reports. I'm going to present you a system, which automatically detects a large portion of those dups.

The Key Idea

If the audience remembers only one thing from your talk, what should it be?

- *What are the contributions:*
  - *You must identify a key idea.* "What I did this summer" is No Good.
  - Be specific. Don't leave your audience to figure it out for themselves (you must pretend that they do not know this!).
  - Be absolutely specific. Say "If you remember nothing else, remember this."
  - Organize your talk around this specific goal. Ruthlessly prune material that is irrelevant to this goal.

Narrow & Deep Beats Wide & Shallow

- *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

Avoid shallow overviews at all costs

Cut to the chase: the technical “meat”

Your Main Weapon

Examples are Your Main Weapon!!

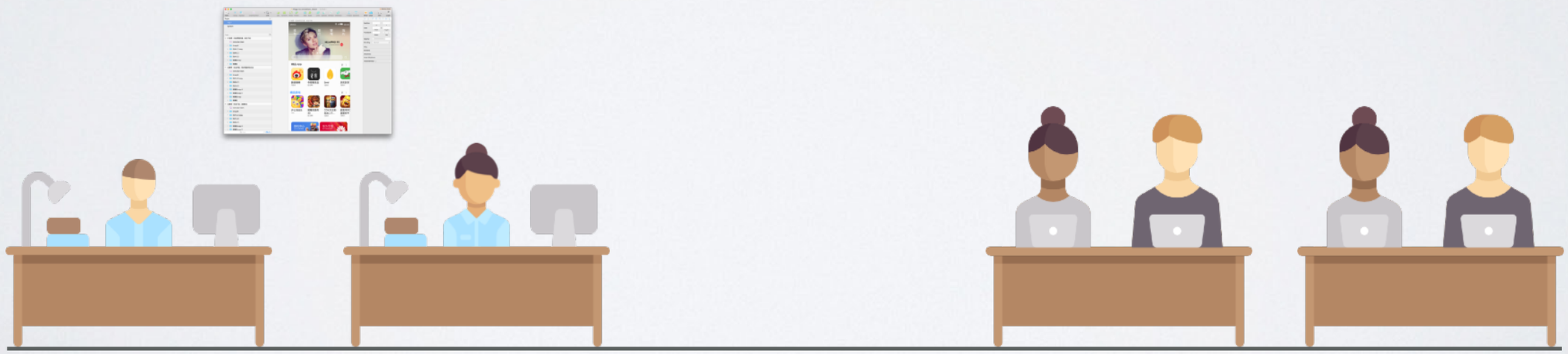
- To motivate the work
- To convey the basic intuition
- To illustrate The Idea in action
- To show extreme cases
- To highlight shortcomings

When time is short, omit the general case, not the example (if you do not have them in the paper – create them! At least the instructor will appreciate that ... extra points ...)

Research Problem

HUAWEI

Sketch



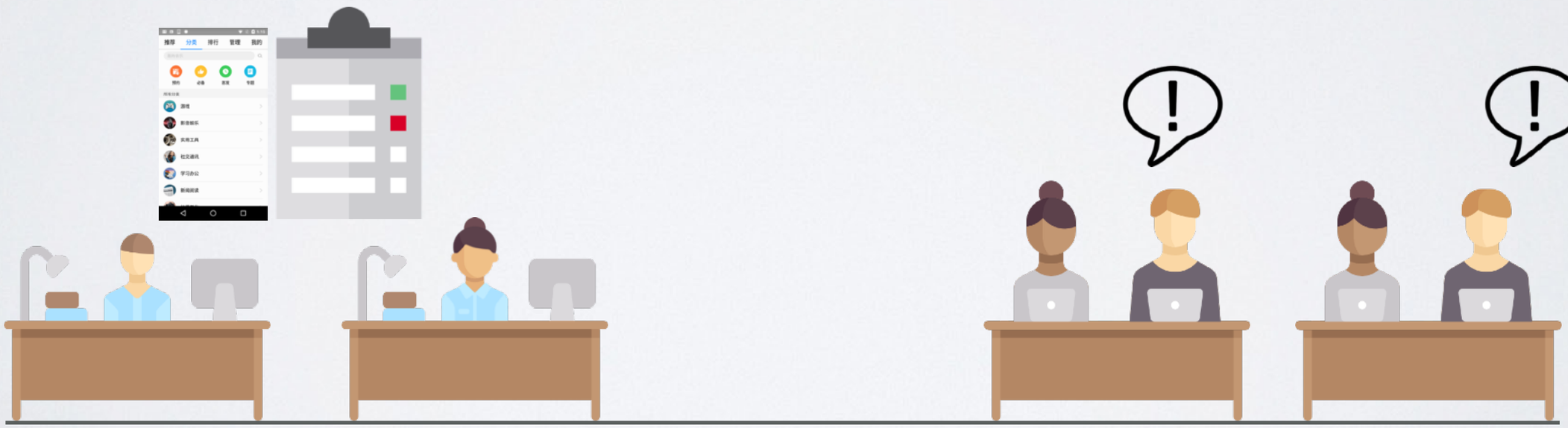
UI/UX Design Team

Development Team

Research Problem

Research Problem

HUAWEI



Research Problem

What to Leave Out

Outline of Your Talk

- Background
- The SITIR approach
- Shortcomings of SITIR
- Overview of Java Platform Debugging Architecture (JPDA)
- Overview of Latent Semantic Indexing
- The Case Studies
- Related work
- Conclusions and further work

No Outline!

- “Outline of your talk”: conveys near zero information at the start of your talk
  - But maybe put up an outline for orientation after your motivation
  - ...and signposts at pause points during the talk

Related Work

- [Wilde'92] The seminal paper on feature location
- [Marcus'04] First use of IR for concept location
- [Antoniol'05] Scenario-based probabilistic ranking of events
- [Poshyvanyk'07] Combining IR with dynamic analysis for feature location
- [Eaddy'08] Combining IR, Dynamic and static analyses

Do not Present Related Work

- But…
  - Although you could present more related papers
  - You absolutely must know the related work; respond readily to questions (you will need to write it as a part of your project report anyway!)
  - Connect it to your project
  - X's very interesting work does Y; I am planning to use the similar technique to Y to extend another work on Z

Technical Details

- 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 ...)

$$\frac{}{\Gamma \vdash k : \tau_k} \qquad \frac{\Gamma \cup \{x : \tau\} \vdash e : \tau'}{\Gamma \vdash \lambda x.e : \tau \to \tau'} \qquad \frac{\Gamma \vdash e_1 : \mathtt{ST}\ \tau^\circ\ \tau \qquad \Gamma \vdash e_2 : \tau \to \mathtt{ST}\ \tau^\circ\ \tau'}{\Gamma \vdash e_1\ \mathtt{>>=}\ e_2 : \mathtt{ST}\ \tau^\circ\ \tau'}$$

$$\frac{\Gamma \vdash e : \tau}{\Gamma \vdash \mathtt{returnST}\ e : \mathtt{ST}\ \tau^\circ\ \tau} \qquad \frac{\Gamma \vdash e : \tau}{\Gamma \vdash \mathtt{newVar}\ e : \mathtt{ST}\ \tau^\circ\ (\mathtt{MutVar}\ \tau^\circ\ \tau)} \qquad \frac{\Gamma \vdash e : \mathtt{MutVar}\ \tau^\circ\ \tau}{\Gamma \vdash \mathtt{readVar}\ e : \mathtt{ST}\ \tau^\circ\ \tau}$$

$$\frac{\Gamma \vdash e_1 : \mathtt{MutVar}\ \tau^\circ\ \tau \qquad \Gamma \vdash e_2 : \tau}{\Gamma \vdash \mathtt{writeVar}\ e_1\ e_2 : \mathtt{ST}\ \tau^\circ\ \mathtt{Unit}} \qquad \frac{}{\Gamma \cup \{x : \forall \alpha_i.\tau\} \vdash x : \tau[\tau_i/\alpha_i]}$$

$$\frac{\Gamma \vdash e : \tau' \to \tau \qquad \Gamma \vdash e' : \tau'}{\Gamma \vdash e\ e' : \tau} \qquad \frac{\Gamma \vdash e : \mathtt{ST}\ \alpha^\circ\ \tau}{\Gamma \vdash \mathtt{runST}\ e : \tau}\ \alpha^\circ \notin FV(\Gamma, \tau)$$

$$\frac{\forall j.\Gamma \cup \{x_i : \tau_i\}_i \vdash e_j : \tau_j \qquad \Gamma \cup \{x_i : \forall \alpha_{j_i}.\tau_i\}_i \vdash e' : \tau'}{\Gamma \vdash \mathtt{let}\ \{x_i = e_i\}_i\ \mathtt{in}\ e' : \tau'}\ \alpha_{j_i} \in FV(\tau_i) - FV(\Gamma)$$

Figure 1. Typing Rules

Omit Some Technical Details

- Even though every line is ***drenched*** in your ***blood*** and ***sweat***, dense clouds of notation will send your audience to sleep
- Present specific aspects only; refer to the paper for the details
- By all means have backup slides to use in response to questions (always know where to locate the details the paper in case if you do not have slides and need to show those details)

Do Not Apologize

- “I didn’t have time to prepare this talk properly”
- “My computer broke down, so I don’t have the results I expected” (for future project presentations)
- “I don’t have time to tell you about this”
- “I don’t feel qualified to address this audience”

Presenting Your Talk

Write Your Slides the Night Before

- (…kidding aside, you should polish the day or night before so they are fresh in your memory)

- Do at least one dry run to yourself
- Your talk absolutely must be fresh in your mind
- Remember that your slides are due by 10:00am on the day of the presentation in .pptx or .key format.

How to Present Your Talk

- By far the most important thing is to

Be Enthusiastic!!!

Enthusiasm

- If you do not seem excited by the idea, why should the audience be? It you are not naturally excited about the idea, you will have to pretend that you are ...
- It wakes ‘em up
- Enthusiasm makes people dramatically more receptive
- It gets you loosened up, breathing, moving around

The Jelly Effect

- If you are anything like me, you will experience apparently-severe pre-talk symptoms
- Inability to breathe
- Inability to stand up (legs give way)
- Inability to operate brain
- Good news: this is just a class presentation. It would be so much intense if you had to present at the conference

What to do About it

- Deep breathing during previous talk
- *Script your first few sentences precisely*
  - (=> no brain required)
- Move around a bit, use large gestures, wave your arms, stand on chairs ...
- You are not a wimp. Everyone feels this way.

Being Seen, Being Heard

- Point at the screen, not at the overhead projector
- Speak to someone at the back of the room
- Make eye contact; identify a nodder (I will be a default nodder in case I agree with your presentation), and speak to him or her (better still, more than one) ...
- Watch audience for questions...

Questions

- Questions are not a problem

- Questions are a ***golden golden golden*** opportunity to connect with your audience

- Specifically encourage questions during/after your talk: if you are comfortable, pause briefly now and then, ask for questions

- Be prepared to truncate your talk if you run out of time (luckily we have some flexibility, but still ...). Better to connect, and not to present all your material

Presenting Your Slides

- A very annoying technique
- is to reveal
- your points
- one
- by one
- by one, unless…
- there is a punch line

Presenting Your Slides

- Use Animation effects

very

very

very

very

very

very

very

very

sparingly

Finishing

Absolutely without fail, finish on time!

- I will give take off 5 points for every minute over 20 minutes that you go
- Audiences get restive and essentially stop listening when your time is up. Continuing is very counter productive
- Simply truncate and conclude
- Do not say “would you like me to go on?” (it’s hard to say “no thanks”)