Course Overview

Eduardo Figueiredo

http://www.dcc.ufmg.br/~figueiredo
topicos.es.eduardo@gmail.com

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Course Language


- Slides are (mostly) in English
  - Speaking in Portuguese
- The exam is in Portuguese
  - You may answer in Portuguese or English as you wish
- Exercises, papers, team work, etc. might be in English or in Portuguese
  - You can choose either English or Portuguese as you wish

What is this course about?

“Intelligent Software Engineering (ISE) applies AI, machine learning, and data mining to enhance software development processes, automating tasks like code generation, debugging, testing, and project management. It integrates intelligent techniques to improve efficiency and decision-making, aiming to shift from manual, traditional methods to automated, data-driven Software Engineering 2.0”

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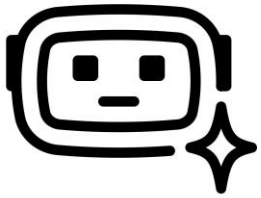

- The course focuses on **Software Engineering**
  - Artificial Intelligence is mostly a “black box”
  - Although we may discuss some very basic AI concepts

Used Literature

- The course does not have a text book, but it may rely on some classic books
  - C. Wohlin et al. **Experimentation in Software Engineering**, Springer. 2012.
  - M. Fowler. **Refactoring: Improving the Design of Existing Code**. Addison-Wesley, 2000.
  - I. Sommerville. **Software Engineering**, 10th Edition. Pearson, 2016.
- Software Engineering research papers
- News and posts from the internet

Course Website

- Slides and agenda are available in the course website
  - Link “Teaching (pt)” in my webpage
  - “Intelligent Software Engineering”

http://www.dcc.ufmg.br/~figueiredo/disciplinas

Email: **topicos.es.eduardo@gmail.com**

Assessment Method

- Undergraduate Students
  - Exam: 40 points
  - Team work: 40 points
  - Exercises: 20 points
- Graduate Students (including "*isolada*")
  - Exam: 30 points
  - Team work: 30 points
  - Exercises: 20 points
  - Paper presentation: 20 points

What is covered in the exam?

- All contents delivered by the professor
- All papers presented in the course
- All exercises

Team Work (TW)

Formation and Tasks

- Groups of up to 5 members
  - No more than three graduate students per group
- Tasks of the team work
  - Design an empirical study on the use of AI models in software engineering
  - Execute the empirical study and report its results in a 10-page technical report

Empirical Strategy

- Your group can choose one or more empirical strategies
  - Survey (Questionnaire or Interview)
  - Systematic Literature Review
  - Controlled Experiment
  - Mining Study, etc.
- See more in the following book
  - C. Wohlin et al. **Experimentation in Software Engineering**, Springer. 2012.

Topic Suggestions

- Groups are free to chose a topic of their interest involving **Artificial Intelligence (AI)** and **Software Engineering (SE)**
  - Example of topics (not limited to)
    - Prompt engineering for SE
    - Automating SE tasks with AI (e.g., code generation, program repair, requirements, architecture, testing, etc.)
    - Human-centered AI for SE (e.g., how software engineers can synergistically work with AI agents)
    - Collaborative AI for SE (e.g., how AI agents collaborate for automating SE)
    - SE Education and Trainning in the AI era

Proposal and Study Design

- Each group has to design the study
  - You have to send an email with the proposal and details about the study design
- This email must be sent by **16/04** in a PDF file (2 to 5 pages) describing
  - Motivation and Problem Statement
  - Goal and Research Questions
  - Steps to be followed in the empirical study
  - Expected measurements and analysis

Oral Presentation

- All groups have to present their study design and results in class
  - Presentations should last between 4 to 6 minutes (time slot may change)
- Each presentation has to include
  - **Motivation**: problem, literature gap, etc.
  - **Planning**: goal, questions, steps, etc.
  - **Results**: measurements, analysis, etc.

Final Report

- The final report should have up to 10 pages in the ACM Proceedings Template
  - https://www.acm.org/publications/proceedings-template
- I recommend the following sections
  - Abstract, Introduction, Background, Study Design, Results and Data Analysis, Threats to Validity, Related Work, Conclusion, References

Grading

- Undergraduate students: 40 points
  - Proposal and Study Design: 10 points
  - Oral Presentation: 10 points
  - Final Report: 20 points
- Graduate students: 30 points
  - 3/4 of each item above

Important Dates

- 02 of April
  - Send the group formation by email
- 16 of April (Proposal)
  - Send the study design by email
- 18 of June (Presentation)
  - Oral Presentation in class
  - Send slides of your presentation by email
- 19 of June
  - Send the final report by email

Exercises and Papers

Exercises

- We expect to have some exercises in this course
  - Exercises can be either face-to-face (in class) or remote
  - Their grades also include participation and paper summaries
- Late deliver penalty policy
  - 20% for up to one day late
  - 50% for up to one week late

Paper Presentation

- Each graduate student ("*isolada*" included) has to present a paper
  - Each presentation should last between 10 to 15 minutes
  - After the presentation, we may have a short discussion (~5 min)
- The list of papers is in the course website
  - Allocation criteria is FIFO
  - Deadline for choosing your paper is **02/04**

Can I choose a different paper?

- If you want, you can present a paper not in the list
  - You have to sent it to me by email
  - I have to approve it
- Criteria for the selected paper
  - Recently published research work (last 5 years)
  - Full research paper (8 to 12 pages)
  - Premier SE conference (ICSE, FSE, ASE)

Paper Summaries

- All students have to write a summary of every paper presented in classes
  - Each summary should be about half page long and written by hand (no typing)
  - **I do not accept a digital file**
- Each summary must have 3 parts
  - What is the paper about?
  - What are its strengths?
  - What are its weaknesses?

An Example of Summary

PRATITIONERS' EXPECTATIONS ON AUTOMATED CODE COMMENT GENERATION

O TRABALHO BUSCAVA ENTENDER A RELAÇÃO ENTRE AS FERRAMENTAS DE GERAÇÃO AUTOMÁTICA DE COMENTÁRIOS EXISTENTES EM COMPARAÇÃO À EXPECTATIVA DOS DESENVOLVEDORES NESSE ASPECTO. OU SEJA, DE MANEIRA MAIS DIRETA, O ESTUDO TINHA POR OBJETIVO CONCLUIR SE O ATUAL ESTADO DAS PESQUISAS E FERRAMENTAS GERADAS NO ÂMBITO DA ESCRITA AUTOMÁTICA DE COMENTÁRIOS É SATISFATÓRIO PARA OS DESENVOLVEDORES NA PRÁTICA.

NESSE SENTIDO, PODEMOS DESTACAR COMO PONTO POSITIVO DO TRABALHO A GRANDE PRESENÇA DE REFERÊNCIAS A OUTROS ARTIGOS CIENTÍFICOS, O QUE INDICA A PREOCUPAÇÃO DOS AUTORES EM SEGUIR BONS PARÂMETROS ACADÊMICOS.

POR FIM, PODEMOS DESTACAR COMO PONTO NEGATIVO DO TRABALHO QUE, POR CONTA DA NATUREZA SUBJETIVA DOS DADOS COLETADOS COM OS DESENVOLVEDORES, UMA VEZ QUE, DEPENDIAM DAS EXPECTATIVAS PESSOAIS DE CADA UM, NÃO PODEMOS CHEGAR A UM CONSENSO GERAL SOBRE O ASSUNTO.

Course Agenda

Main Contents

- Introduction to Software Engineering
- Introduction to Artificial Intelligence
- AI techniques for Software Engineering
- Prompting Engineering for Developers
- AI Models for SE Activities
  - Requirements and Architecture
  - Programming and Testing
- Evaluation of AI Results in SE