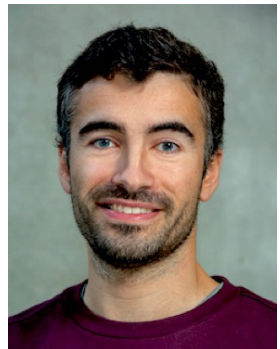


Organization and Course Schedule

Release Engineering for Machine Learning Applications
(REMLA, CS4295)

Sebastian Proksch <S.Proksch@tudelft.nl>

Luís Cruz <L.Cruz@tudelft.nl>



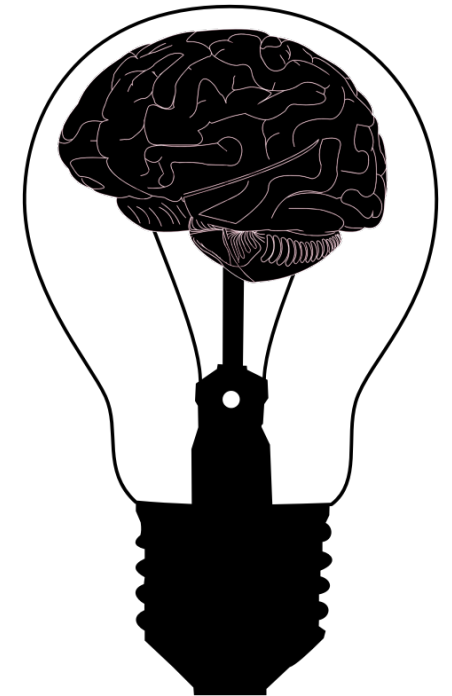
What is Release Engineering?

“...the compilation, assembly, and delivery of source code into **finished products** or other software components.” (Wikipedia)

“... the difference between manufacturing software in small teams or startups and **manufacturing software in an industrial way** that is **repeatable**, gives **predictable results**, and **scales** well ...”
(Adams et al. “The Practice and Future of Release Engineering”, IEEE)

Why RE for Machine Learning Applications?

- Machine Learning is the rising star discipline that is driving digital innovation and **transforming businesses** everywhere.
- Tech companies are embracing the AI race to keep their businesses competitive.
- Although Machine Learning projects are similar to Software Engineering projects, they have interesting differences that set them apart:
 - Huge dataset artifacts
 - Very experimental development.
 - Transdisciplinary development teams
 - ...
- Hence, SE standards and practices ought to be revisited to scope ML projects
- In this course, we will cover:
 - The most recent breakthroughs in ML Engineering.
 - Show how to deploy ML using advanced RE techniques.



Learning Objectives of REMLA (CS4295)

After following this course, students are able to...

- Apply standard techniques of release engineering
- Apply version control techniques to machine learning artifacts, like data or models
- Design a deployment pipeline for a machine learning application
- Implement quality control techniques in a machine learning pipeline
- Analyze and improve existing deployment pipelines
- Evaluate and document design decisions in deployment pipelines

Who are we?

Sebastian Proksch

- Ass Prof. at SERG
- Postdoc at Uni Zurich
- PhD at TU Darmstadt



Interests:

- Static and dynamic analysis of CI Configuration
- Software Development Tools
- Team Processes

Luís Cruz

- Ass. Prof. at SERG
- Scientific Manager
AI for Fintech
- PhD at U. Porto



Interests:

- Green Software
- AI Engineering

Course Components

Lectures

- Preparing Material
- Theory

Tutorials

- Putting theory into practice
- Get to know state of the art technology

Individual

Essay

- Reflect on Basic RE Pipeline
- Design Useful extension

Project

- Implement your vision
- Apply RE to your own project

Group Project

Course Schedule









Times:

Monday, 3:45pm

Wednesday, 1:45pm

Friday, 1:45pm (*)

(*) to be clarified

	Monday	Tuesday	Wednesday	Thursday	Friday	
W1	Intro (Structure, Project) Project Template, Data Format		 CDel/CDepI		Deployment to XX	Lectures: 4h Tutorials: 2h Reading: 3h Programming: 4h
W2	 Containerization		Docker, (Kubernetes?)		 ML Pipelines	Lectures: 4h Tutorials: 2h Reading: 6h Programming: 4h
W3	 Testing		Holiday		(Re-)Train Model Unit tests++ for ML	Lectures: 2h Tutorials: 4h Reading: 4h Programming: 4h
W4	 Monitoring + Continuous Experimentation		Define Metrics, Instrument App, Logging		Holiday	Lectures: 4h Tutorials: 2h Reading: 6h Programming: 4h
W5	 Literature Survey		How to write a paper / How to present		 Review Current Pipeline, Pipeline Extension Proposal	Lectures: 2h Lit-Survey: 8h Review: 20min
W6	Self-Study		First Draft of ToC + Introduction			Reading: 4h Programming: 8h Writing: 4h
W7	Self-Study		Individual Steering Meetings			Programming: 8h Writing: 8h Review: 20min
W8	Self-Study		Sketch of Methodology or new pipeline			Programming: 8h Writing: 8h
W9	Self-Study					Programming: 4h Writing: 8h Presentation: 4h
W10	 Essay Presentation				Total: 134h Lectures: 16h Tutorials: 10h Reading: 31h Programming: 44h Writing: 28h Presentation: 4h Reviews: 1h	Review: 20min
	Lecture		Lab		Assessment (form./summ.)	

Lectures + Tutorials

Essay + Project

Contents

Lectures

- Continuous {Integration, Delivery, Deployment}
- Containerization & Orchestration
- ML Pipelines
- ML Testing
- Best Practices in SE4ML
- Monitoring & Continuous Experimentation

- Scientific Writing & Presentation

Tutorial

- Every lab session consist of practicing concepts taught in the lectures.
- Improve an existing basic ML application. (SMS Spam Detection)
- Every lab session will focus on a different angle of the application to make it production-ready.
 - Deployment
 - Docker, Kubernetes,
 - ML testing, ML Pipeline management (DVC)
 - Define Metrics, Instrument App, Logging

Project

Project Organization

- Groups of pairs(?) (max. 12 groups)
- Second half of the course (weeks 5–10)
- Weekly steering meetings (Feedback and formative assessment)

Luís will give a more extensive introduction in a minute.

Grading

Course Components

35% Final release engineering pipeline
(focus: how well is the project executed)

60% Essay
(focus: how well have design decisions been evaluated and documented)

5% Presentation
(focus: clarification and fraud prevention)

Course Page

<https://se.ewi.tudelft.nl/remla/>

REMLA

REMLA Rubrics

Release Engineering for Machine Learning

In this course, we will go on a journey that starts at continuous integration and then moves on to continuous delivery, continuous deployment, and continuous experimentation. We will discuss the theory and the current research on various related subjects like containerization, testing, or monitoring and will put the learned theory into practice. As a running example, we will build a pipeline for a machine learning application, which – compared to traditional release engineering – poses additional challenges, like data versioning or model deployment.

Learning Objectives

After following this course, you will be able to:

- Apply standard techniques of release engineering;
- Apply version control techniques to machine learning artifacts, like data or models Design a deployment pipeline for a machine learning application;
- Implement quality control techniques in a machine learning pipeline;
- Analyze and improve existing deployment pipelines;
- Evaluate and document design decisions in deployment pipelines.

Central place for
announcements,
information and
material!

Links

- **Course Page**
<https://se.ewi.tudelft.nl/remla/>
- **Brightspace**
<https://brightspace.tudelft.nl/d2l/home/280442>
- **Project Template**
<https://github.com/luisacruz/SMS-Spam-Detection>
- **Study Guide**
https://studiegids.tudelft.nl/a101_displayCourse.do?course_id=56383
- Mattermost Channel? Mailinglist?