SCHOOL OF COMPUTATION, INFORMATION AND TECHNOLOGY — INFORMATICS

TECHNISCHE UNIVERSITÄT MÜNCHEN

Master's Thesis in Informatics

FLOps: Practical Federated Learning via Automated Orchestration (on the Edge)

Alexander Malyuk

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TODO

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I confirm that this master's thesis is n and material used.	ny own work and I	have documented all sources
Munich, 15.09.2024		Alexander Malyuk



Abstract

Kurzfassung

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1 Introduction

- 1.1 Problem Statement
- 1.2 Motivation
- 1.3 Contribution
- 1.4 Thesis Structure

2 Background

2.1 Federated Learning

- **2.1.1 Basics**
- 2.1.2 Architectures
- 2.1.3 Research
- 2.1.4 Industry
- 2.1.5 Frameworks & Libraries
- 2.1.6 Flower

2.2 Machine Learning Operations

- 2.2.1 DevOps
- **2.2.2 MLOps**
- 2.2.3 MLflow

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- 2.3.1 Fundamentals
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3 Requirements Analysis

4 System Design

5 Object Design

6 Evaluation

- 6.1 Rationale
- 6.1.1 Chosen Experiments
- 6.2 Experimental Setup
- 6.2.1 Monolith
- 6.2.2 Multi-Cluster
- 6.2.3 Evaluation Procedure
- 6.3 Results
- **6.3.1 Basics**
- 6.3.2 Image Builder
- 6.3.3 Different ML Frameworks/Libraries & Datasets
- 6.3.4 Multi-cluster & HFL

7 Conclusion

- 7.1 Limitations & Future Work
- 7.1.1 Federated Learning via FLOps
- **7.1.2** Complementary Components & Integrations

8 DELME tum example

8.1 Section

Citation test [Lam94].

Acronyms must be added in main.tex and are referenced using macros. The first occurrence is automatically replaced with the long version of the acronym, while all subsequent usages use the abbreviation.

E.g. \ac{TUM} , \ac{TUM} \Rightarrow Technical University of Munich (TUM), TUM For more details, see the documentation of the acronym package¹.

8.1.1 Subsection

See Table 8.1, Figure 8.1, Figure 8.2, Figure 8.3.

Table 8.1: An example for a simple table.

A	В	C	D
1	2	1	2
2	3	2	3

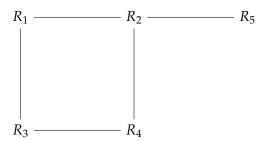


Figure 8.1: An example for a simple drawing.

¹https://ctan.org/pkg/acronym

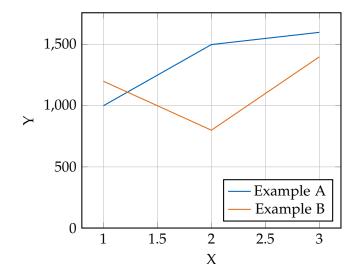


Figure 8.2: An example for a simple plot.

```
SELECT * FROM tbl WHERE tbl.str = "str"
```

Figure 8.3: An example for a source code listing.

Abbreviations

TUM Technical University of Munich

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Bibliography

[Lam94] L. Lamport. *LaTeX : A Documentation Preparation System User's Guide and Reference Manual.* Addison-Wesley Professional, 1994.