



LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
MÜNCHEN

DEPARTMENT OF MATHEMATICS

LABORATORY FOR QUANTITATIVE RISK CONTROL



LMU quantLab Workshop Series • 2020

Machine Learning and Algorithmic Differentiation

Dr. Benedikt Wilbertz
Prof. Dr. Christian Fries

main workshop:

Thursday, February 20th, 2020

Friday, February 21th, 2020

optional exercise session:

Saturday, February 22th, 2020

venue:

quantLab - Room B 121

Institute of
Mathematics

LMU

Theresienstr. 39

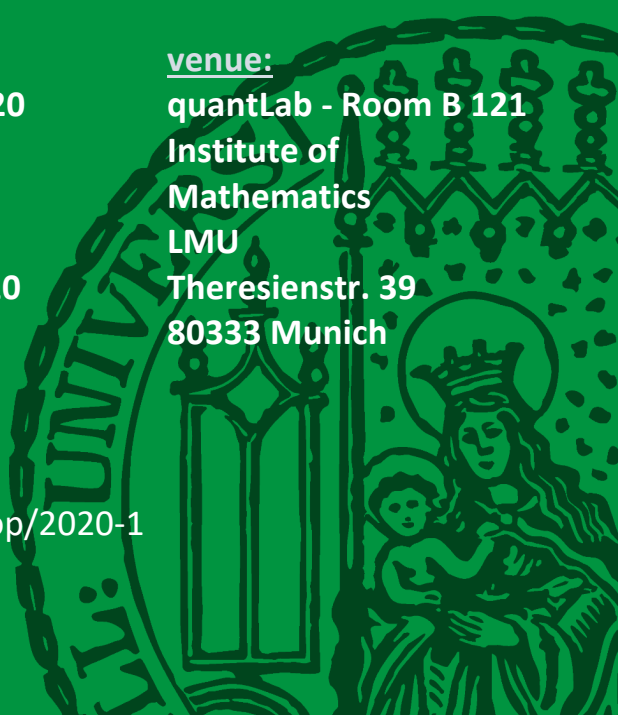
80333 Munich

details / registration

<http://quantlab.info/workshop/2020-1>

contact:

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Agenda (Tentative)

Algorithmic Differentiation

Introduction to Algorithmic Differentiation

- Algorithmic Differentiation (AD)
- Adjoint AD (AAD)

Enabling Software Design Patterns

- Interfaces
- Dependency Injection

Stochastic Algorithmic Differentiation:

AAD for Monte-Carlo Simulations

- AAD of Conditional Expectations
- AAD of Indicator Functions

Application from Mathematical Finance

- Hedge Simulation
- Margin Valuation Adjustment

Numerical Experiments

Helpful Knowledge

- Basic knowledge of R (for Machine Learning)
- Basis knowledge of a Programming (Java, C++, C#, C) / OO (for AAD)
- Basics in options pricing theory (for Applications from Finance)

Machine Learning

Introduction to Machine Learning

- Concepts of supervised learning
- Bias-Variance trade-off and model performance
- Feature engineering

Linear and Non-Linear Regression Models

- Linear models
- Support vector machines

Classification Models

- Decision Trees
- Random Forest
- Gradient Boosting
- Model Ensembling

Deep Learning

- Stochastic gradient descent and optimization for neural networks
- Neural network architectures and applications

Model Interpretability

- Visualizations
- Causal Modelling