

# Mini-Workshop

# Anomaly Detection

# with Neural Networks

21.02.2020

II. Physikalisches Institut (Subatomare Physik)  
Justus–Liebig–Universität Giessen

Elias Brandstetter, Johannes Bilk, Johannes Budak, Katharina Dort,  
Irina Heinz, Stephanie Käs, Jens Sören Lange, Peter Lehnhard,  
Marvin Peter, Simon Reiter

# Gäste

Prof. Andreas Dominik (THM, Neuronale Netze)

Prof. Christian Heiliger (JLU, Physik)

Prof. Markus Holzer (JLU, Informatik)

Dr. Johannes Lang (JLU, Medizin)

PD Olena Lynn timer (JLU, Physik)

Dr. Christian Mandler (JLU, Mathematik)

Dr. Martin Obert (JLU, Chemie/Radiologie)

Dr. Holger Repp (JLU, Medizin)

Prof. Klaus Rinn (THM, Mustererkennung)

Prof. Lorenz von Smekal (JLU, Physik)



ELSEVIER

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**NUCLEAR  
INSTRUMENTS  
& METHODS  
IN PHYSICS  
RESEARCH**  
Section A

# Transputer self-organizing map algorithm for beam background rejection at the BELLE silicon vertex detector

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# The goal

1. Search for „new physics“  
(rare events in a large amount of data)

*Case A: we know what we want*

tetraquarks, magnetic monopoles, antideuterons, ...

*Case B: we don't know what we want*

„free“ running search for anomalies

2. unsupervised

3. in realtime in hardware (e.g. FPGA)

# Anomaly detection with neural networks

Friday 21 Feb 2020, 09:00 → 16:00 Europe/Berlin

Chemistry EG 18 (Giessen University)

09:30 → 10:00 Coffee

09:30 → 12:30 Presentations I

10:00 **Overview (experimental setup, pixel and clusters, search for rare events with new physics, results from multilayer perceptron, results from self-organizing maps)** 40m  
Speaker: Katharina Dort (JLU Giessen)

10:40 **Understanding the n-dim data (principal components analysis, results from self-organizing maps with transformed input)** 25m  
Speaker: Stephanie Käs (JLU Giessen)

11:05 **Results from Hopfield networks** 25m  
Speaker: Irina Heinz (JLU Giessen)

11:30 **Convolutional Networks** 30m  
Speaker: Klaus Rinn (THM)

12:00 **Growing self-organizing maps** 30m  
Speaker: Marc Strickert (JLU Giessen)

12:30 → 13:30 Pizza 1h

13:30 → 16:00 Presentations II

13:30 **Deep learning applications for the CBM experiment at Fair and the NA61 experiment at CERN** 30m  
Speaker: Olena Lyynik (JLU Giessen, FIAS, milch&zucker)

14:00 **Hardware implementation (FPGA, GPU)** 30m  
Speaker: Jens Sören Lange (JLU Giessen)

14:30 **Discussion and Wrap-Up** 1h 30m

PIZZA

in the Grundpraktikum

next to the main entrance door

PHOTO for the *uniforum*

anyone not in favor?