technische universität
dortmund

Chair of Data Science and Data Engineering
Prof. Dr. Emmanuel Müller

Anomaly Detection Seminar 2021/2022

September 1, 2021

Today

- Kick-Off
- Some Formal Stuff
- Short Overview of the Topics

- Choose a couple topics
- Send your choice to Simon.Kluettermann@cs.tu-dortmund.de (till tomorrow 02.09.2021 23:59)
- You will be assigned one the next day

Objective of this Seminar

- Introduction to some fundamental research problems
  - Researching current scientific ideas
  - Understanding benefits and drawbacks of state-of-the-art techniques
  - Writing a clear and concisive scientific report
  - Presenting and discussing your findings

→Great start for a masters thesis.. or even a PhD in anomaly detection

Grading

1. Presentation in Class
2. Writing of your Report
3. Discussion of your Findings

- All parts required and graded equally

Tasks of this Seminar

- Required: willingless to learn something new
- Also useful: A basic understanding of machine learning, statistics and linear algebra
  1. Choose a couple of Topics from our list, you will be assigned to one of them
  2. Read and understand the Paper given to you
  3. Find, read and understand related literature. It is probably impossible to get a good picture about your Topic from just one Paper
  4. Critically analyze the suggested Ideas and compare them to the literature
- Final Results:
  - Presentation (30min +10min discussion)
  - Written Report (at least 6 Pages double column, ACM template)

Research Culture

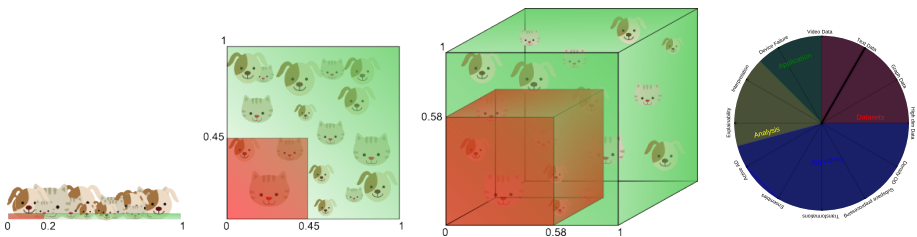
This course is Research oriented

- Feel free to ask as many Questions as you want
- If you want to discuss your Topic with somebody, make an appointment with your Supervisor
- the same holds for your Presentation/Report
- Also any Feedback is always appreciated

Topic 1: High dimensional Data

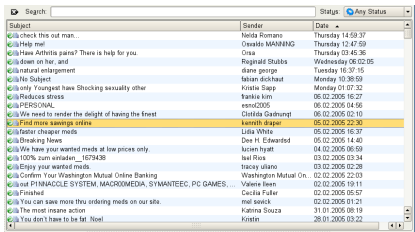
A comprehensive survey of anomaly detection techniques for high dimensional big data (Thudumu et al, 2020)

Supervisor: Jelle Hüntelmann (jelle.hüntelmann@cs.uni-dortmund.de)



Topic 2: Text Data

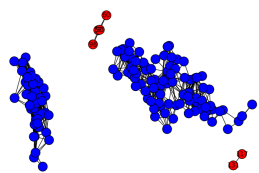
Outlier Detection for Text Data (Kannan et al, 2017)
Supervisor: Simon Klüttermann (simon.kluettermann@cs.uni-dortmund.de)

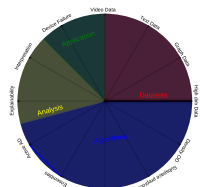


Topic 3: Graph Data

A Comprehensive Survey on Graph Anomaly Detection with Deep Learning (Ma et al, 2021)

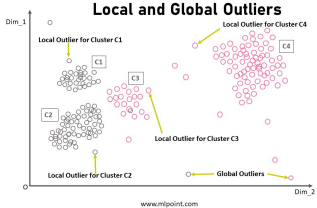
Supervisor: Simon Klüttermann (simon.kluettermann@cs.uni-dortmund.de)

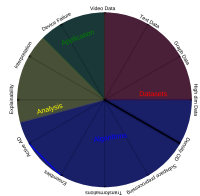




Topic 4: Density based Outlier Detection

LOF: Identifying Density-Based Local Outliers (Breunig et al, 2000)
Supervisor: Daniel Wilmes (daniel.wilmes@cs.uni-dortmund.de)

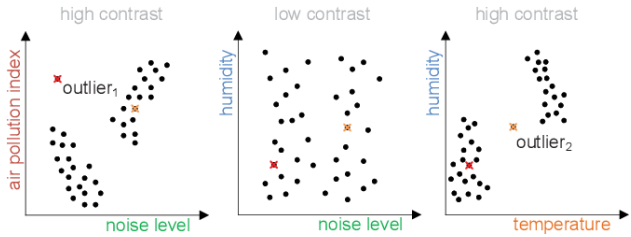


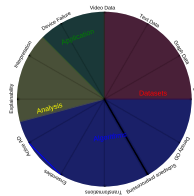


Topic 5: Subspace preprocessing

HiCS: High Contrast Subspaces for Density-Based Outlier Ranking (Keller, Müller et al, 2012)

Supervisor: Daniel Wilmes (daniel.wilmes@cs.uni-dortmund.de)

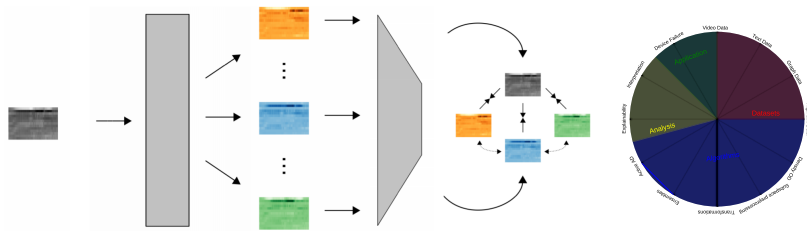




Topic 6: Transformations for Anomaly Detection

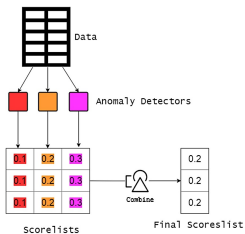
Neural Transformation Learning for Deep Anomaly Detection Beyond Images (Qui et al, 2021)

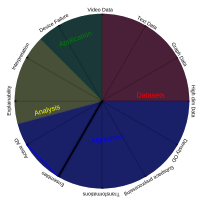
Supervisor: Bin Li (bin.li@tu-dortmund.de)



Topic 7: Anomaly Ensembles

Unsupervised Anomaly Detection Ensembles using Item Response Theory
(Kandanaarachchi1, 2021)
Supervisor: Simon Klüttermann (simon.kluettermann@cs.uni-dortmund.de)

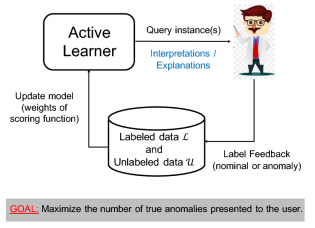


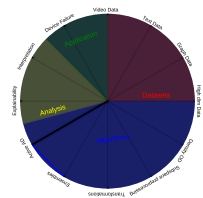


Topic 8: Active Anomaly Detection

Active Anomaly Detection via Ensembles: Insights, Algorithms, and Interpretability (Das et al, 2019)

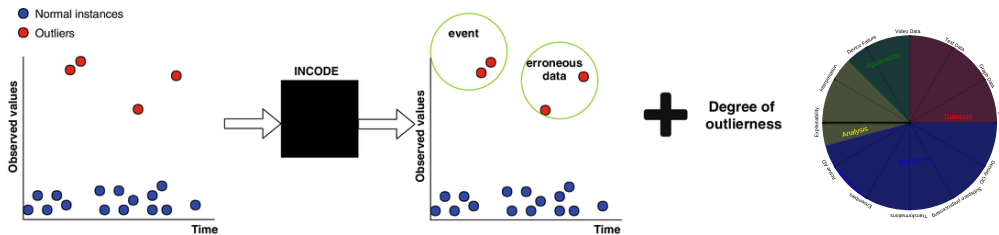
Supervisor: Simon Klüttermann (simon.kluettermann@cs.uni-dortmund.de)





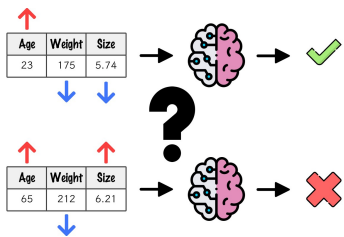
Topic 9: Interpretation

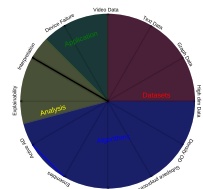
Contextual Outlier Interpretation (Liu et al, 2017)
Supervisor: Benedikt Böing (benedikt.boeing@cs.uni-dortmund.de)



Topic 10: Explainability

Additive Explanations for Anomalies Detected from Multivariate Temporal Data
(Giurgiu, Schumann et al, 2019)
Supervisor: Chiara Balestra (chiara.balestra@cs.uni-dortmund.de)

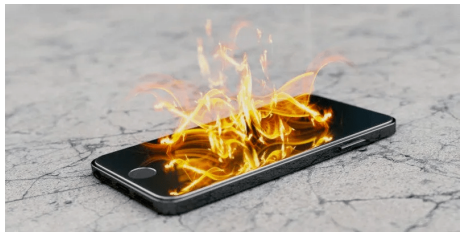


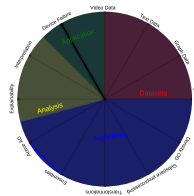


Topic 11: Application: Interpretable Device Failure

Interpretable, Multidimensional, Multimodal Anomaly Detection with Negative Sampling for Detection of Device Failure (Sipple et al, 2020)

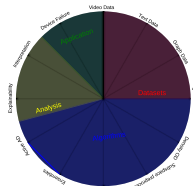
Supervisor: Bin Li (bin.li@tu-dortmund.de)

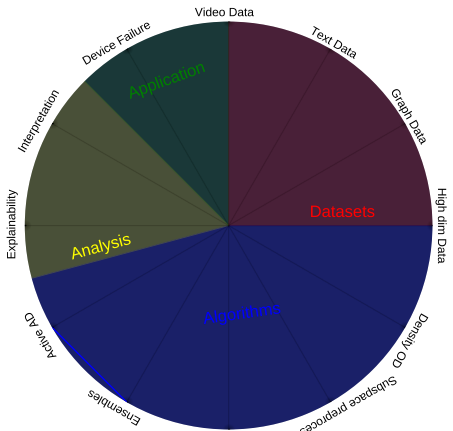




Topic 12: Application: Video Data

Fast Unsupervised Anomaly Detection in Traffic Videos (Doshi et al, 2020)
Supervisor: Jelle Hüntelmann (jelle.hüntelmann@cs.uni-dortmund.de)

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Graph Data
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Density OD
Subspace preprocessing
Transformations
Ensembles
Active AD
Explainability
Interpretation
Device Failure
Application
Datasets
Analysis
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