

Data Science & Artificial Intelligence

Center for Digital Safety & Security

AIT Austrian Institute of technology GmbH

ALEXANDER SCHINDLER

Thematic Coordinator Data Science
Data Science & Artificial Intelligence
Center for Digital Safety & Security

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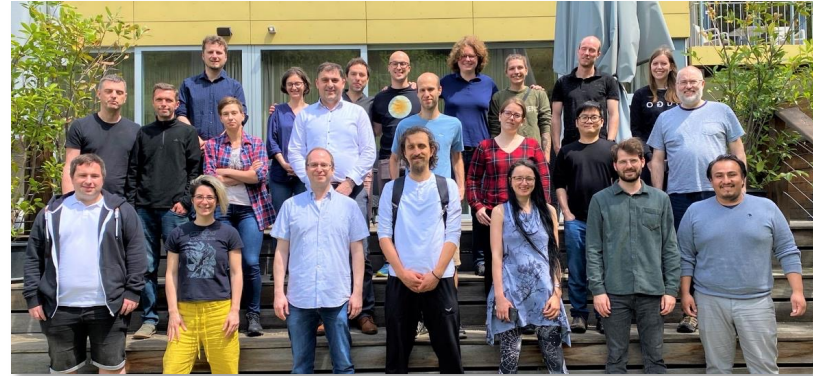
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GROUP OVERVIEW

- Head of Competence Unit: Dr. Ross King
- Group Size: 40
 - 8 Seniors (2 Thematic Coordinators)
 - 26 Scientists / Research Engineers
 - 4 Junior Scientists
 - 1 Technician



Data Science & Artificial Intelligence

R&D Domains

Cultural Data Science

- FAIR Data Principles
- Digital Preservation
- Electronic Archiving
- Culturomics

Industrial Data Science

- Digitalisation
- Industry 4.0
- Predictive Maintenance
- Spatial DS

Data Science for Public Security

- Virtual Assets and DeFi
- Consumer Protection
- Disinformation
- Hybrid Threats
- Assisting LEAs
- Anti-Terror

Green Data Science

- Sustainable Forestry & Agriculture
- Extreme Weather & Climate Change
- Circular Economy
- Green AI

NLP

Computer Vision

AI Audio

Trustworthy AI

Geo-spatial
Analytics

AI Ethics

Applied Artificial Intelligence

XAI

Trustworthy AI

Image/Video

- Object Detection
- Object Tracking
- Biometrics
- Media Forensics

Audio

- Event Detection
- Scene Classification
- Keyword Detection
- Speech to Text
- Embeddings & Similarity

Text

- Named Entity Recognition
- Sentiment detection
- Hate Speech detection
- Sexism detection
- Text Similarity
- Large Language Models

Time Series

- Anomaly Detection
- Predictive Maintenance
- Geo-Spatial analysis
- Movement prediction

Multi-Modal Analytics

Applied Artificial Intelligence Fraud Detection



Topic-Lead:

Mag. Andrew Lindley
Research Engineer

Customers:

- Austrian government agencies
- Watchlist Internet
- Free Service for Austrian consumers

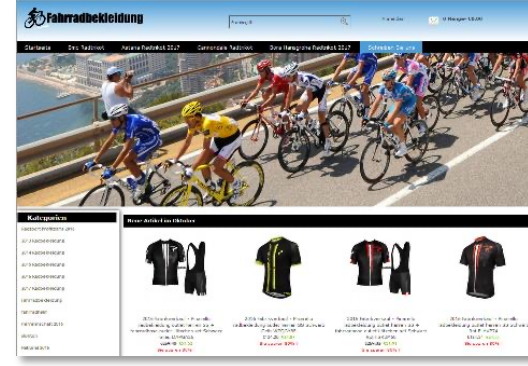
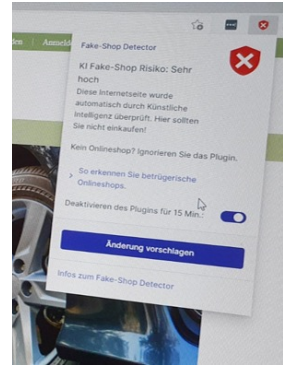
Topic Goals:

- **Prevention through technical security measures**
 - Fraudsters operate at a rapid pace, fake-shops are deployed at large numbers and most often have a limited uptime.

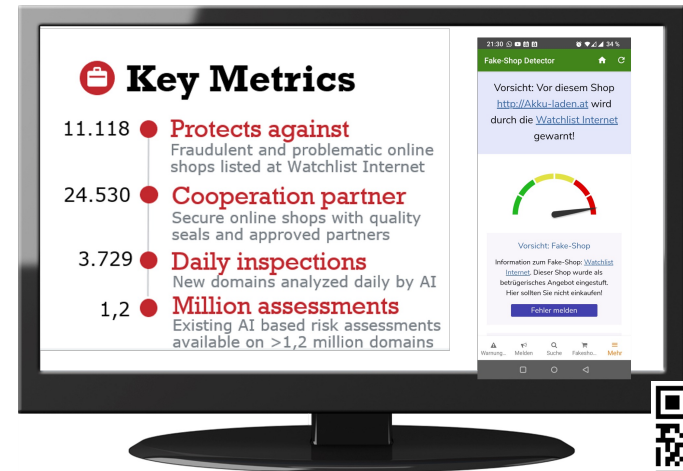
- Reduce the window of opportunity for fraudsters by protecting consumers from new fake-shops in real-time
- Support automation in expert organizations

Topic Results:

- **Fake-Shop Detector (FSD) Infrastructure & Tools**
 - Integrated Tools and Workflows for Expert Organizations; Enabling an additional AI based 'perspective' for experts
 - Browser Plugin (protect yourself and others) for consumers
 - Fake-Shop Archive and trained AI models to detect Fake-Shops based on their 'similarity' to already known threats in real-time



<http://www.anwalt-wendelmuth.de/>
OIAI certified FAKE



Applied Artificial Intelligence

Disinformation Detection

Topic-Lead:

Dr. Alexander Schindler
Thematic Coordinator
Multi-Modal AI

DI. Martin Boyer
Senior Research
Engineer

Customers:

Austrian government agencies

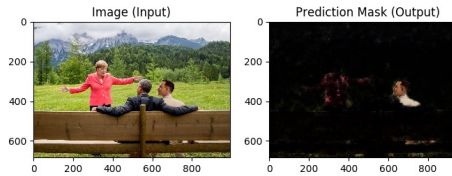
Topic Goals:

- Identify disinformation threats
- Identify Hate Speech & Extremism
- Analyse Hybrid Threats & Threats against critical infrastructures

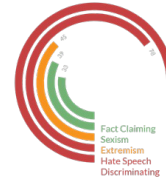
Topic Results:

- Threat analysis report
- Prototype detectors for
 - Fake faces
 - Extremist Symbols
 - Deepfakes
 - Misleading news
 - Extremist Content
 - Sexism, writing/reporting style, etc.

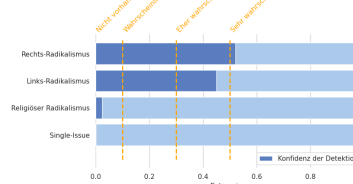
Image manipulation detection



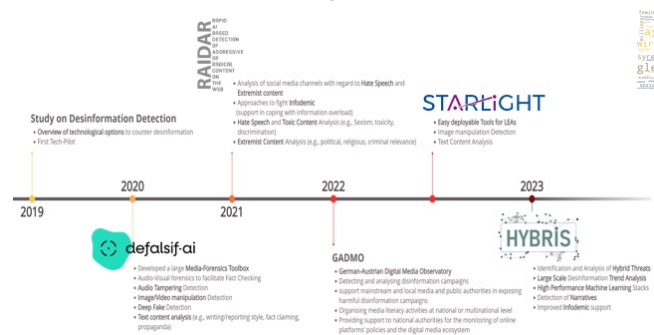
Recognise fake profile photos



Content Analysis / Classification



Research Project Line



Recognising the recording location

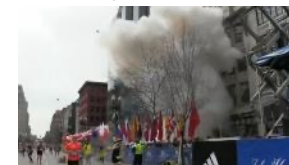


Applied Artificial Intelligence

Multimedia Forensics



Detect Explosions, Gunshots, etc.



Topic-Lead:

Dr. Martin Boyer
Senior Research Engineer

Dr. Alexander Schindler
Thematic Coordinator
Multi-Modal AI

Dr. Sven Schlarb
Scientist

Customers:

Law Enforcement Agencies (nat., EU)

Topic Goals:

- Identify investigation relevant concepts in mass multi-media data
- Assist LEAs agents in identifying relevant content / suspects (Crime, Terrorism)
- Reduce information overload

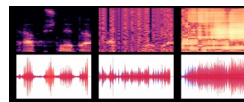
Topic Results:

- Visual object detectors / trackers
- Acoustic Scene Classification
- Audio Event Detection
- Audio Similarity Search
- Speaker Identification / Diarization
- Acoustic Keyword Spotting
- Named Entities: Weapons, Drugs

Weapon Detection (in Text)

I have a **Beretta WEAPON_MANUFACTURER** 92G Elite II I am looking to sell. It is a 9mm **QUANTITY** designed for **IDPA ORG** or **USPSA GPC** shooting. It has the heavier Brigadier slide to help reduce felt recoil and muzzle flip. It has night sights. The G model means it is the de-cocker only model. No manual safety like a regular **Beretta PRODUCT** 92 FS. It operates more like a Sig 226 in that the de-cocker will drop the hammer safely, but the gun is still ready to fire in double action. These are very hard to find. **Beretta PRODUCT** no longer makes them. It is very similar in set up to the new Wilson Combat Custom Berettas. Comes with original case and two **CARDINAL** magazines. I got it intending to use it to shoot **IDPA ORG**, but I have a **Glock WEAPON_MANUFACTURER**

Noise Invariance



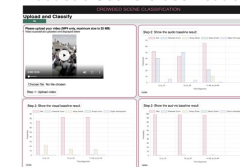
Acoustic Keyword Spotting



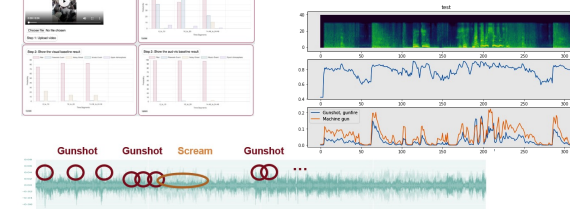
Search by example / content-similarity



Acoustic Scene Classification



Audio Event Detection



Applied Artificial Intelligence

Network monitoring and analysis

Topic-Lead:

Dr. Pedro Casas
Senior Scientist

Customers:

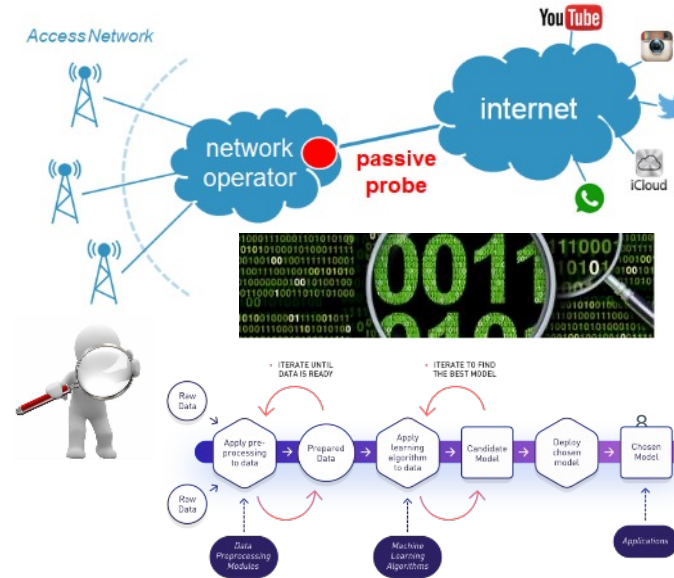
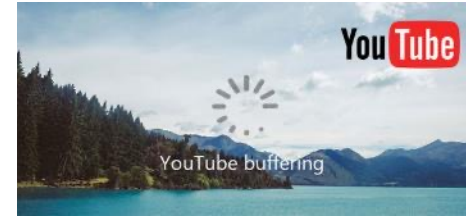
Telecommunications equipment manufacturer

Topic Goals:

Design and develop a machine-learning based system for end-to-end monitoring of encrypted streaming traffic

Topic Results:

- Machine learning models to predict occurrence of streaming degradation in encrypted traffic
- Machine learning models to predict user watching and playback behavior in encrypted traffic
- Open software-based monitoring solution for monitoring of encrypted network traffic
- Improvement of network management capabilities under encrypted network traffic scenarios



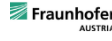
Industrial Data Science

Deep Learning for Outage prediction

Topic-Lead:

Dr. Clemens Heisstracher
Scientist

Customers:



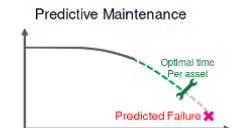
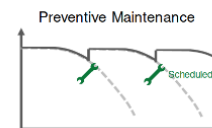
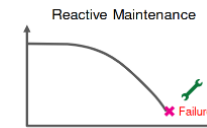
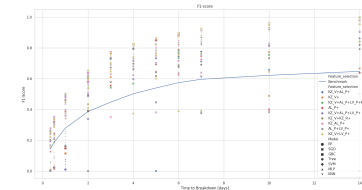
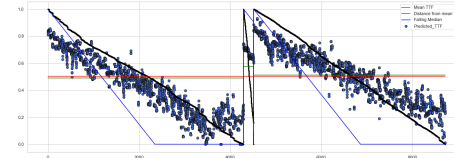
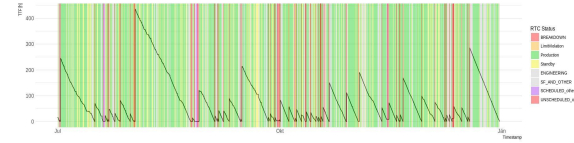
Topic Goals:

Provide generic algorithmic building blocks for

- outage prediction in data streams
- data-driven maintenance strategy for plasma etch systems

Topic Results:

- Explainable DL models for predicting outages
- Stream-based analytics and visualization algorithms
- Data-driven maintenance and decision support models
- Machine learning models for predicting time-to-failure (TTF)
- Prediction models with precisions up to 90%, potential reduction of down-time between 12-21%, increased overall availability of 2%
- Maintenance strategy and deployment concept
- Recommendations for further increasing data quality and prediction capabilities



Applied Artificial Intelligence

Spatial Data Science

Topic-Lead:

Dr. Anita Graser
Scientist

Customers:

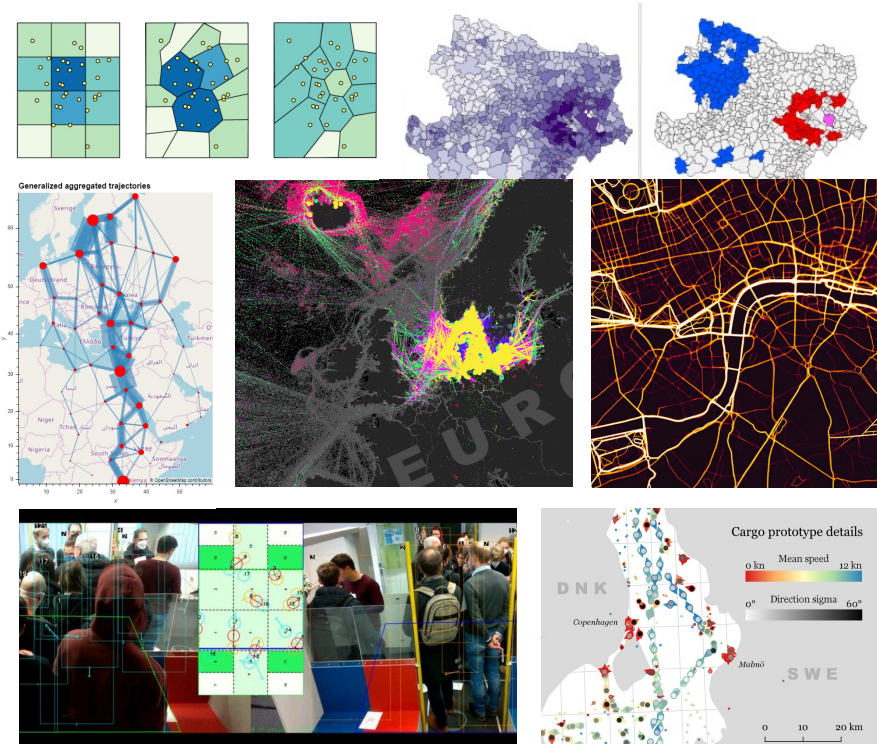
Frequentis, Seasy, Siemens

Topic Goals:

- Provide methods and tools to build AI for spatiotemporal data
- Apply geospatial machine learning (GeoAI) to improve model results

Topic Results:

- Spatiotemporal analytics & visual analytics
- Location selection & classification
- (Geo)Data-driven machine learning
- Movement classification, prediction & anomaly detection



Applied Artificial Intelligence

Green Data Science

Topic-Lead:

Dr. Jasmin Lampert
Senior Scientist

Customers:



Topic Goals:

- AI and Data Science methods for tackling climate change
- Making AI algorithms computationally more efficient
- Development of physics-informed machine learning framework for weather and climate predictions

Topic Results:

- Explainable AI models for predicting tree growth
- Data-driven prediction of vermin occurrence
- Susceptibility maps for shallow landslides
- Data quality assurance for environmental sensors

Lage der Monitoringflächen
 TLS measurements: 2022, 2023, 2024
 Kern-Intensivbeobachtungsfäche
 Intensivbeobachtungsfäche
 TLS measurements: 2023

Processed Point Cloud **Data extraction**

Tree canopy model: Mörzschlag **Tree Crown Reconstruction: Mörzschlag**

ID	longitude	latitude	z_base	z_top	height	circumf.	species	94	97	99	dbh	height	maxd	avgd
27	10	-50794.6	277511.2	754.64	1	7.99	24.2	25.6	26.3	tree_2017	0.355	0.42954	1.01170	
28	31	-50793.5	277508.8	726.76	1	7.48	21.6	23.6	24.2	tree_2015	0.417	0.50354	1.01782	
31	34	-50791.2	277512.5	708.83	1	15.38	37	38.1	38.5	tree_2015	0.475	0.48504	0.44487	
54	60	-50796.8	277524.8	706.03	1	10.34	25.1	25.9	24.8	tree_2044	0.302	0.33333	1.00040	
57	60	-50795.8	277519.0	703.08	1	5.78	21.8	22.1	22.9	tree_2015	0.347	0.37476	1.00166	
70	60	-50806	277519.8	752.98	1	11.44	24.1	25.7	26.1	tree_2041	0.57	0.50047	0.92124	
82	68	-50798.4	277513	706.75	1	10.88	26.2	27.2	27.8	tree_2015	0.305	0.32476	0.40009	
83														
84														

Database for Modelling **Sample Plot 15: Mörzschlag**

Natürliche Intelligenz künstlich verstehen
 Ein Artikel von Anja Zelles (BFW), Karl Gartner (BFW) | 28.10.2022 - 12:12

Über den Baumumfang können vielerlei Rückschlüsse auf Baumgesundheit und Wachstum gemacht werden. Im Zuge des FFG-geförderten Projekts AI4Trees versuchen Forschende nun, mittels künstlicher Intelligenz die natürlichen Vorgänge dahinter besser zu verstehen. Ziel ist neben der Untersuchung von Extremereignissen auch die Identifikation wichtiger Monitoringparameter.

Prediction vs actual data

Applied Artificial Intelligence

Explainable AI

Topic-Lead:

DI. Anahid Jalali
Scientist

Customers:

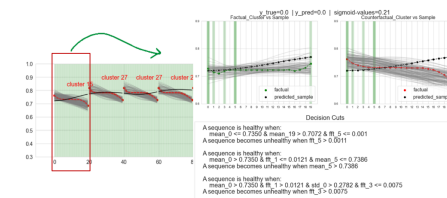
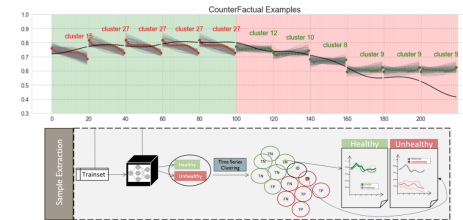
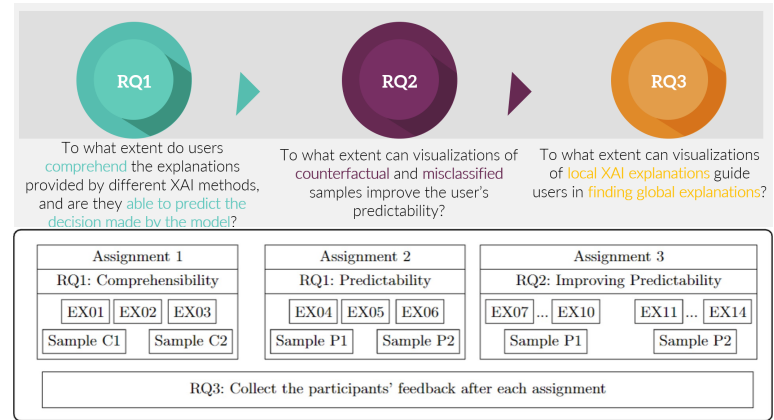
Lateral topic

Topic Goals:

- Identify influential feature on model prediction
- Assist developers and/or domain experts with boosting the model performance & increasing data quality
- Increasing system's interpretability

Topic Results:

- Visualizations of model agnostic & specific
 - locally explained influential features
 - globally explained influential features
 - Cohort explained influential features
- A user centric XAI Evaluation setup
- Interactive environment for experts to extract local & global explanations from a trained model



QUESTIONS AND DISCUSSION

Alexander Schindler

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