PATRICK KOLLER

PhD Student

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OVERVIEW

PhD student with a passion for advancing the fields of explainability, domain adaptation/generalization, and machine learning model robustness. Backed by over 10 years of hands-on industry experience in algorithm and software development, machine learning, and project management, I am driven to bridge the gap between cutting-edge research and real-world applications.

EDUCATION

09/2024 - Today **PhD in Electrical and Computer Engineering** — **Northwestern University**

- PhD Student in Prof. Dr. Katsaggelos's Image and Video Processing Lab (IVPL).
- Focusing on signal processing, machine learning and explainable AI methods.

02/2020 - 02/2023 **Master of Science in Data Science** — **Eastern Switzerland University of Applied Sciences**

- Part-time studies alongside working as an engineer at Stettbacher Signal Processing AG. Grade: 5.52/6
- Master Thesis: Development of a novel explainable AI method called "Caption-based explainable AI" at the Image and Video Processing Lab at Northwestern University under the supervision of Prof. Dr. Katsaggelos, Prof. Dr. Guido Schuster and my mentor Amil Dravid. Grade: 6/6
- Development of a quantitative trading engine using a combination of fixed horizon and triple barrier labels, gaussian processes to accelerate the hyperparameter tuning and a novel trading strategy. Grade: 5.5/6
- Development of an "AI in injection molding" anomaly detection model, which is able to classify the quality of produced goods using the cavity pressure curve. We optimized a wide range of machine learning models like linear regression, autoencoder, variational-autoencoder, convolutional-autoencoder, gated-recurrent-unit-autoencoder, elliptic envelope, isolation forest, local outlier factor, and one-class support vector machines on a NVIDIA DGX-2. An autoencoder based model delivered the best performance considering the restricted resources of the embedded system. The success of this thesis led to the implementation in a product called ComoNeo by Kistler AG. Grade: 5.5/6

05/2014 **Vocational Trainer for Automation Engineers** — **Berufsbildner AG**

09/2012 - 09/2016 **Bachelor of Science in Electrical Engineering** — **Zurich University of Applied Sciences**

- Part-time studies alongside working as an automation engineer at Comsys Bärtsch AG.
- Bachelor thesis: Development of electronics, optics, mechanics, and software for a medical device to detect brucellosis. A lock-in algorithm allows to detect a signal hidden in the noise. Grade: 5.5/6
- Development of a force control system in a stranding machine to prevent a corkscrew effect during custom cable production. The project has been rewarded with a 1'500.00 CHF price by the company Huber + Suhner AG. Grade: 5.5/6

08/2007 - 08/2011 **Apprenticeship as an Automation Engineer** — **Comsys Bärtsch AG AG**

WORK AND RESEARCH EXPERIENCE

07/2023 - Today **Data Scientist / Project Leader** — **Kistler AG**

- Development of a proprietary machine learning model to estimate the velocity of a vehicle for a passive speed camera system using difference brightness sensors only.
- Minimize the number of scrap parts during production by training a proprietary machine learning model on the available process data to contribute to Kistler AG's vision of a smart factory.
- Consulting Kistler AG's business unit "Plastics" about the "AI in injection molding" model implemented in their product ComoNeo.

03/2023 - 06/2023 **Traveller** — **All over the world**

Exploring the most beautiful places in America, Canada, Columbia, Portugal, and Switzerland.

06/2017 - 02/2023 **Engineer / Project Leader** — **Stettbacher Signal Processing AG**

- Mounting a stereo camera on a waste disposal truck, enables to track and locate the handle of a waste container. A transfer learning approach applied to the YOLOv5 model in combination with data augmentation enables to adapt the model to its new task with just a few dozen images.
- Development of an acoustic impedance measurement device for the textile industry used by EMPA - Swiss Federal Laboratories for Materials Science and Technology.
- Contribution to the custom linux system, the bluetooth stack, and the eye tracking algorithm of an eye-surgery device, which won the Red Dot Award in 2018.
- Development of the electronics, the custom linux system and the software of a ruggedized tablet. The unique selling proposition of this device is the brightest display in the world used in a tablet.

10/2016 - 05/2017 **Development engineer / Project Leader** **Optotune AG**

- Leading a team of 10 people, some having a PhD in electronics, mechanics, chemistry, and photonics. We developed a three axis robot, which automatically produces liquid tunable lenses for the smartphone industry. The success of the project led to the implementation of these liquid tunable lenses in the Xiaomi Fold 1 and Fold 2.
- To produce the liquid tunable lenses, a membrane with unique properties is needed. I was responsible for the machine and for the optimization of that process. After successfully optimizing the PID controllers, the yield increased by 20%.

08/2016 - 09/2016 **Traveller** **Eastern Europe**

Exploring the most beautiful places in eastern Europe on an Interrail tour across Slovenia, Croatia, Serbia, Hungary, Czech Republic, Austria, and back to Switzerland.

08/2011 - 04/2016 **Automation Engineer / Project Leader** **Comsys Bärtsch AG AG**

Developing software with PID controllers for home automation and smart home applications. I was also responsible for the vocational training of Nicolas Kleinert and Sandro Rovetto.

SERVICE AND TEACHING EXPERIENCE

09/2023 - Today **Master thesis mentor** **Kistler AG**

Mentoring Ken Geeler over the course of his master thesis classifying the correct air pressure in tires using a machine learning model and Kistler AG's Weight In Motion sensor.

11/2019 - 04/2021 **Volunteer coach** **Powercoders**

Coaching refugee Sharif Shayan during his internship at UBS (largest Swiss bank), which led to a permanent position at Brack.ch (Swiss e-commerce company).

03/2013 - 01/2016 **Math tutor** **Freelancer**

Math tutoring for Robin Kreis, Nicolas Kleinert, Roman Kümpel and Sandro Rovetto.

SKILLS

Language	Swiss German (Native), German (Fluent), English (Fluent), French (Basic)
Programming	Python, Matlab, R, C, C++, JAVA, Shell, Bash, HTML, CSS, LaTeX
ML libraries	Keras, PyTorch, TensorFlow, Scikit-learn, NumPy, SciPy, Pandas, Matplotlib, Seaborn
Development tools	Jupyter notebook, Visual Studio Code, Eclipse, RStudio, Conda, vi
Version control	Git, Gitlab, Github, SVN
Databases	MySQL, PostgreSQL
Operating systems	Linux, Windows

PRESENTATIONS

11/2023	Presentation to Kistler AG's business unit "Plastics" about the "AI in injection molding" project from my master's studies, which has been implemented in Kistler AG's ComoNeo.
07/2023	Introduction of the concept of interpretable machine learning models to Kistler's Innovation Lab using a story about getting a personal loan. The presentation about permutation importance, LIME, partial dependence plots and shapley values is hosted on my Github profile.
02/2023	Presentation at Northwestern (In person) and Eastern Switzerland University of Applied Sciences (Online) about the novel explainable AI method called "Caption-based explainable AI".
08/2022	Presentation at Eastern Switzerland University of Applied Sciences about the quantitative trading engine using gaussian processes to accelerate the hyperparameter tuning.
02/2022	Presentation at Eastern Switzerland University of Applied Sciences about the "AI in injection molding" anomaly detection model, which is able to classify the quality of produced goods using the cavity pressure curve.
07/2016	Presentation at Zurich University of Applied Sciences about the development of the medical device to detect Brucellosis using a lock-in algorithm to detect a signal buried in noise.

01/2016 Presentation at Zurich University of Applied Sciences about the force control system in a stranding machine to prevent a corkscrew effect in custom cable production.