
# DL Exercise 4: PyTorch and Classification Challenge

F. Thamm, Z. Yang, K. Breininger, S. Jaganathan, C. Liu, L. Rist, N. Maul, L. Folle, N. Gourmelon, Z. Pan, M. Zinnen, K. Packhäuser, B. Geissler, S. Sun, M. Vornehm, J. Wolf, E. Wittmann, W. Karbole, N. Panchi

Pattern Recognition Lab, Friedrich-Alexander University of Erlangen-Nürnberg

June 30, 2021

# Goal of this exercise

- Get to know a widely used deep learning framework: PyTorch
- Implement & train a variation of a widely used architecture: ResNet
- Classification on **real** data: Images from solar panels

# Goal of this exercise

- Get to know a widely used deep learning framework: PyTorch
- Implement & train a variation of a widely used architecture: ResNet
- Classification on **real** data: Images from solar panels
- **Challenge yourself & your colleagues!**

# Organizational

## Part I: Classification with PyTorch - Mandatory

- Implementation & training of a PyTorch architecture
- Submission of trained models in submission system (later more)
- Code upload to StudOn
- Goal: reach a mean F1 score > 0.60
- **Deadline: TBA**

# Organizational

## Part II: Challenge - Optional, but highly encouraged

- Try to find & train the best architecture & model for this task!
- Compete with your colleagues!
- **Deadline: TBA**


Source: Designed by Freepik

# Data set: Identification of defects in solar panels

- Solar modules are composed of cells
- Are subject to degradation (transport, wind, hail, ...)
- Different defects, e.g., cracks or inactive regions

# Data set: Identification of defects in solar panels

- Solar modules are composed of cells
- Are subject to degradation (transport, wind, hail, ...)
- Different defects, e.g., cracks or inactive regions
- **Task:** Automatically determine which defect(s) a module has
- Panel can have no or multiple defects ➔ **multi-label problem**!

# Data set: Identification of defects in solar panels

- Solar modules are composed of cells
- Are subject to degradation (transport, wind, hail, ...)
- Different defects, e.g., cracks or inactive regions
- **Task:** Automatically determine which defect(s) a module has
- Panel can have no or multiple defects ➔ **multi-label problem**!

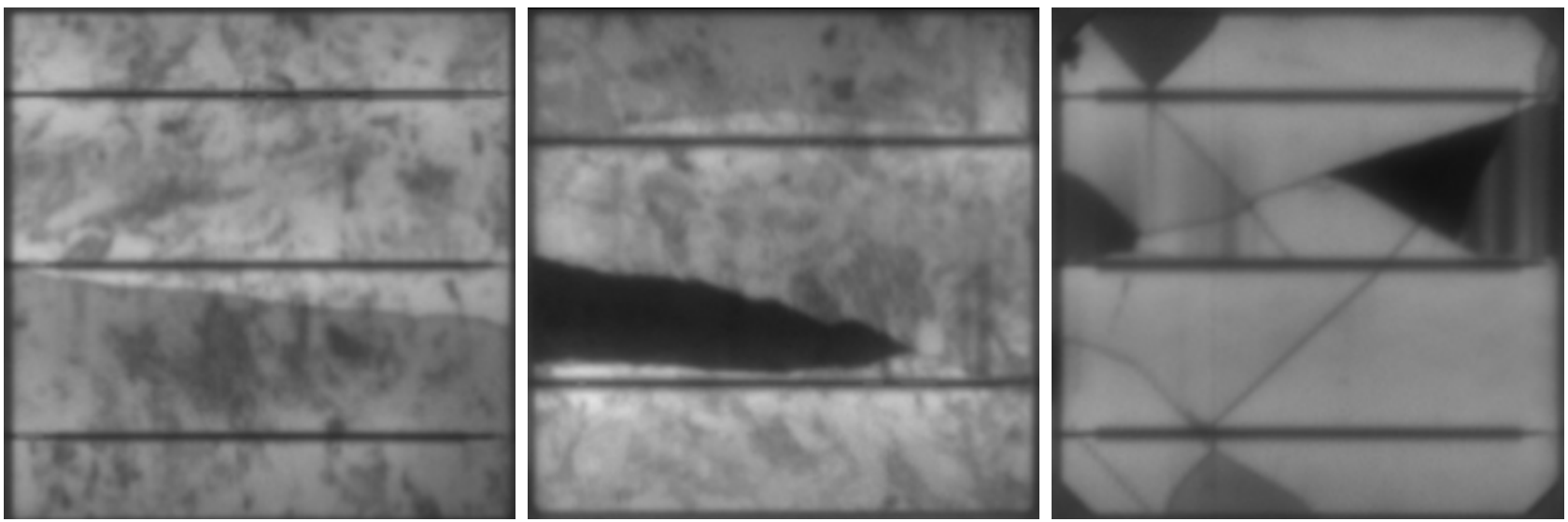


Figure: Left: Crack on a polycrystalline module; Middle: Inactive region; Right: Cracks and inactive regions on a monocrystalline module

# Normalization

- The normalization of your implementation has to match the normalization of our test server
- Mean $\mu$ and standard deviation $\sigma$ of the intensity over all test samples are known
- We normalize every pixel $x$ by $x^* = \frac{x-\mu}{\sigma}$
- Please make sure that you implement the normalization accordingly

# Deep Learning in PyTorch

We will use **PyTorch** to define and train neural network architectures.

- Developed by Facebook's AI Research lab
  - Open-source
  - Extensive Python interface
- Allows to easily define computational graphs
  - Operations based on **tensors**
  - Closely resembles NumPy API
  - Automatic differentiation to support efficient gradient computations (**Autograd**)
  - Various optimization algorithms to help training neural networks
- + GPU acceleration!

# Deep Learning in PyTorch

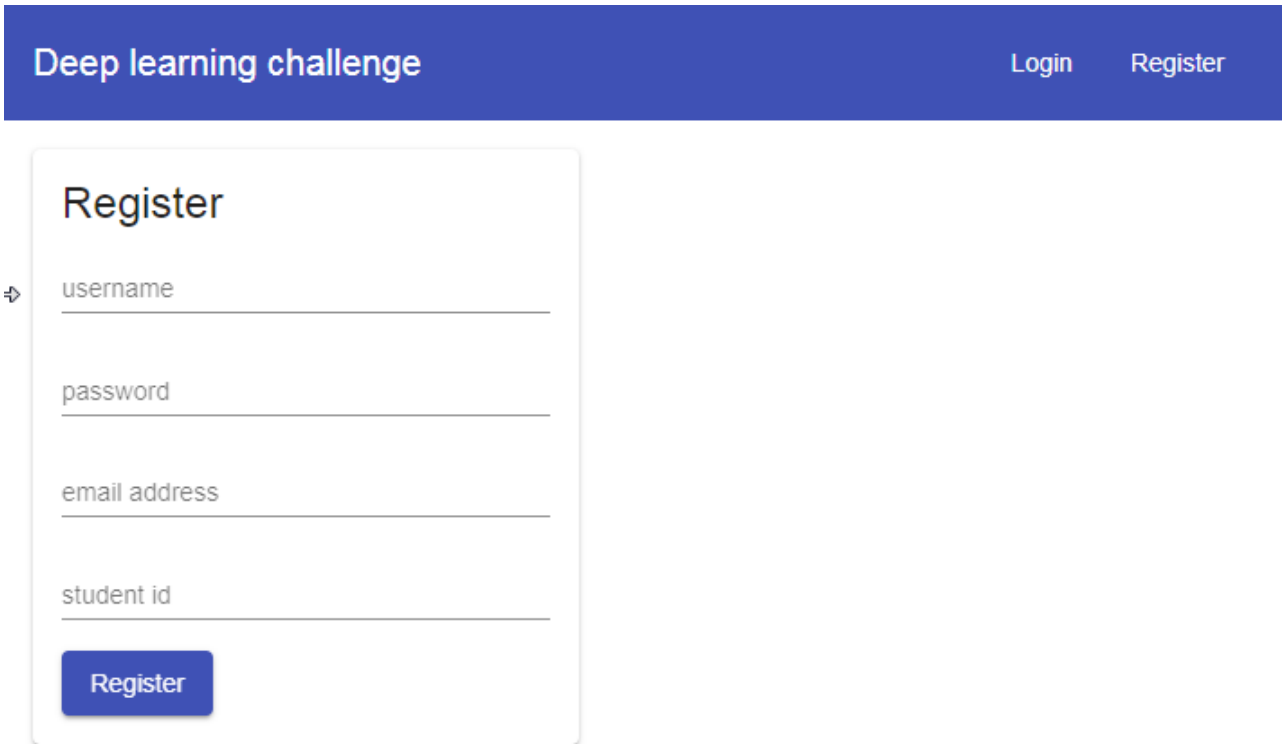
- PyTorch layer API resembles structure of our framework
- Extensive documentation and “getting started” guides
- Short Hands-On will follow after Ex. 3 submission
- Sources online e.g.:
  - 60-min blitz with Jupyter notebooks
  - PyTorch with examples
  - Overview of all tutorials

# Submission to online tool

- After training, make sure to save a checkpoint of your best performing model
- Online submission tool will be made available on **TBD**
- Website: https://lme156.informatik.uni-erlangen.de/dl-challenge
- **Only available from within the university network**
- Same teams (max. 2) as before allowed

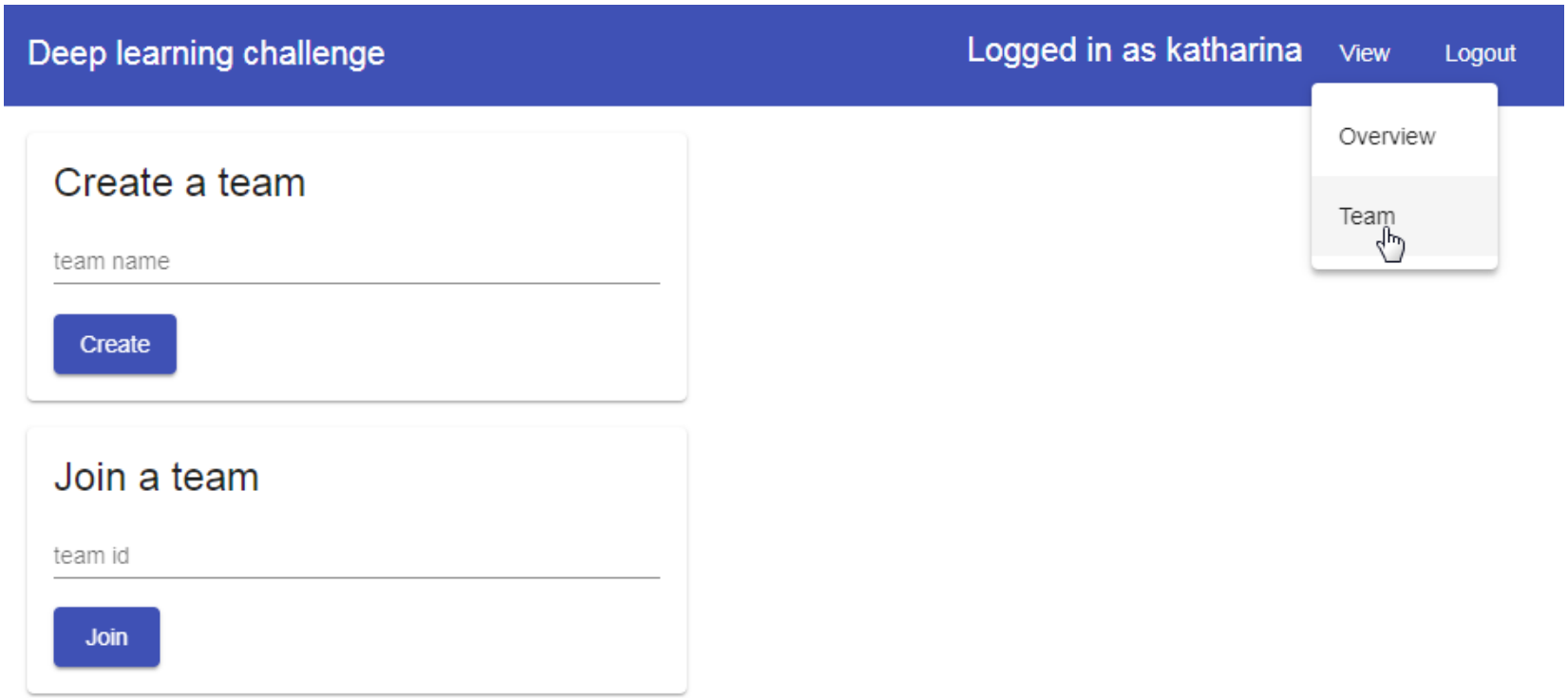
# Submission to online tool: Registration

Register with your email and student id.



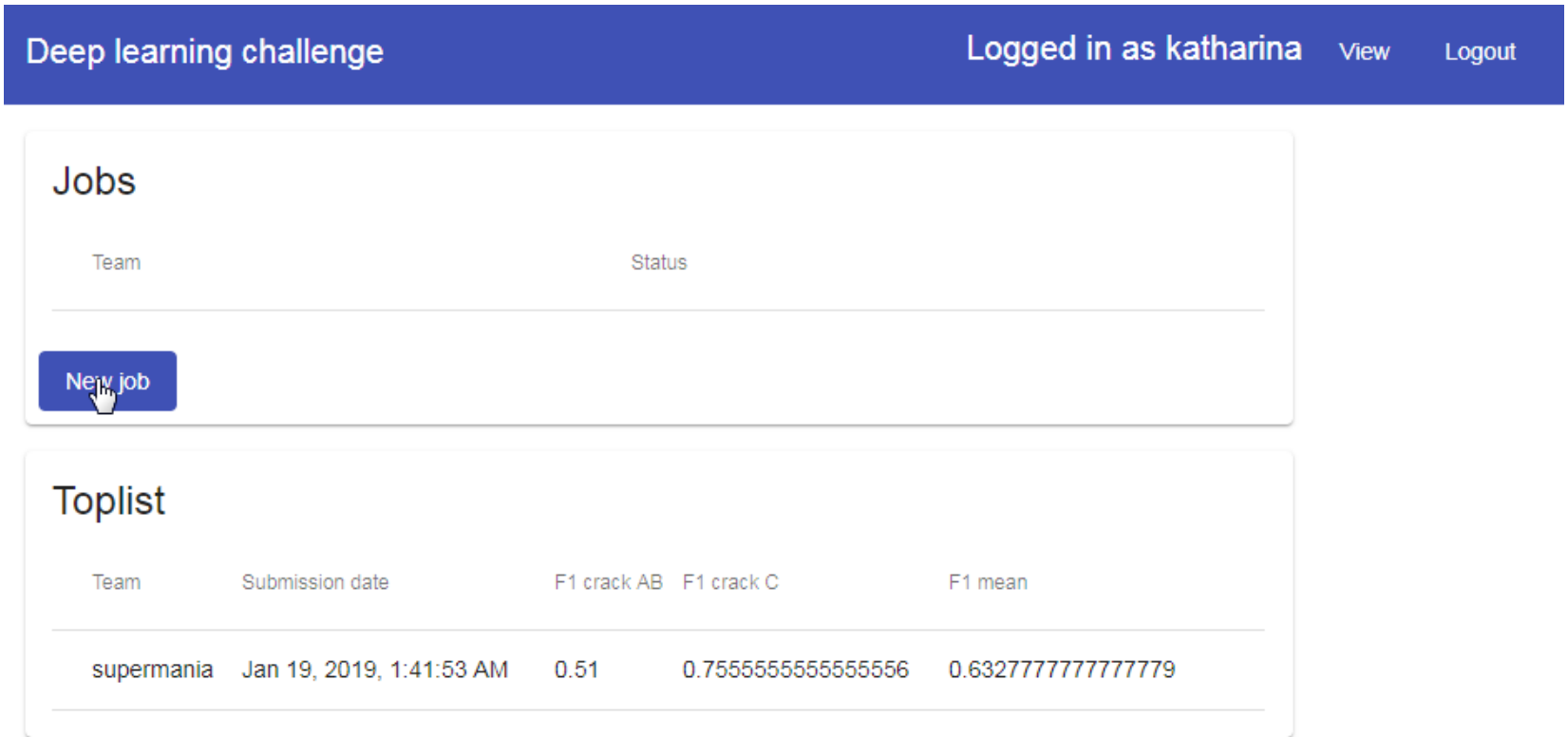
# Submission to online tool: Team

If you work in a team: One of you has to create a new team, the other has to join.



# Submission to online tool: Submit model

Submit trained models (zip-file generated by train.py) by uploading them. You may submit multiple models.



# THE CHALLENGE

## Improve on the baseline of ResNet:

- Adapt architecture/try out new architectures
- Pretraining?
- Regularization?
- Data augmentation?
- Use your creativity!
- Best model from each team will be tested on independent data after the challenge deadline
- **Best participants will receive a winner's certificate and a prize!**

# THE CHALLENGE

## Improve on the baseline of ResNet:

- Adapt architecture/try out new architectures
- Pretraining?
- Regularization?
- Data augmentation?
- Use your creativity!
- Best model from each team will be tested on independent data after the challenge deadline
- **Best participants will receive a winner's certificate and a prize!**
- **May the best machine learners win!**