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Report from the Front Lines of Deep Learning

Deep Learning Workshop, Bern, June 06, 2018

Thilo Stadelmann

swiss group for artificial intelligence and cognitive science

Swiss Alliance for Data-Intensive Services

datalab

www.zhaw.ch/datalab

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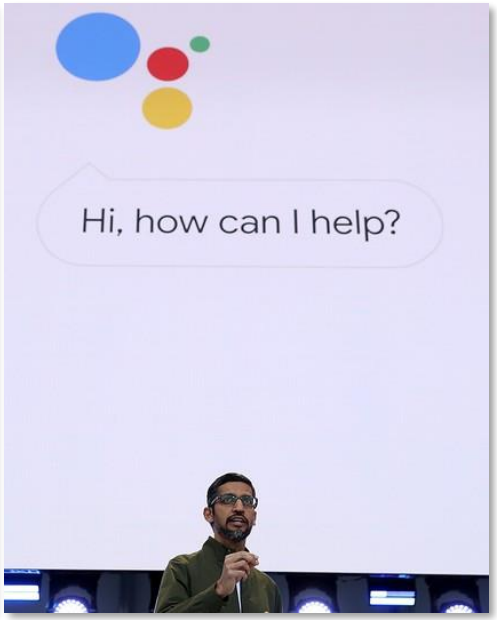
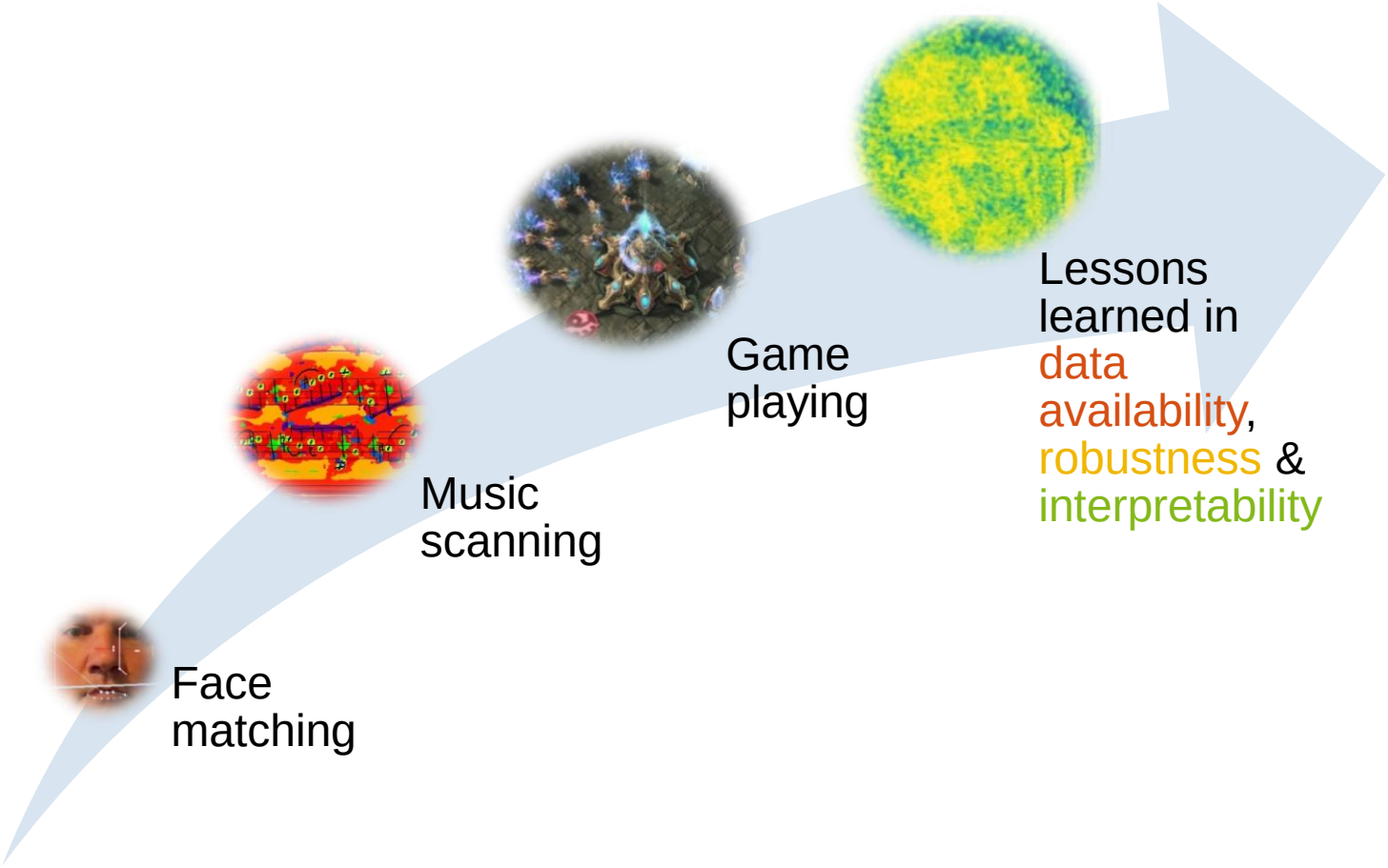
Why?



Agenda


Face matching
Music scanning
Game playing
Lessons learned in data availability, robustness & interpretability

Face matching

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[!] DEEPIMPACT

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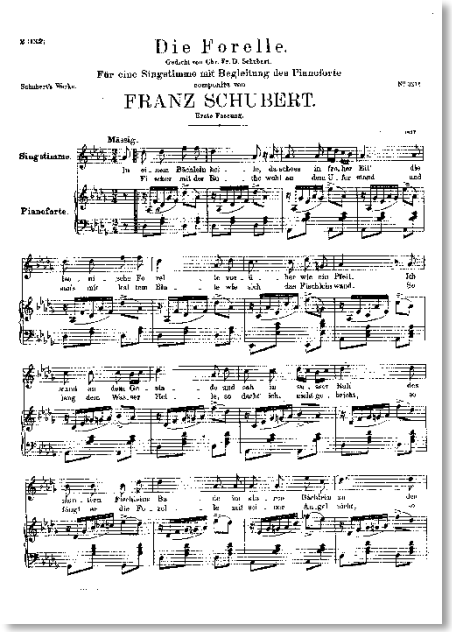
Face matching

Music scanning



Die Forelle.

Gedicht von Chr. Fr. D. Schubart.

Für eine Singstimme mit Begleitung des Pianoforte

componirt von

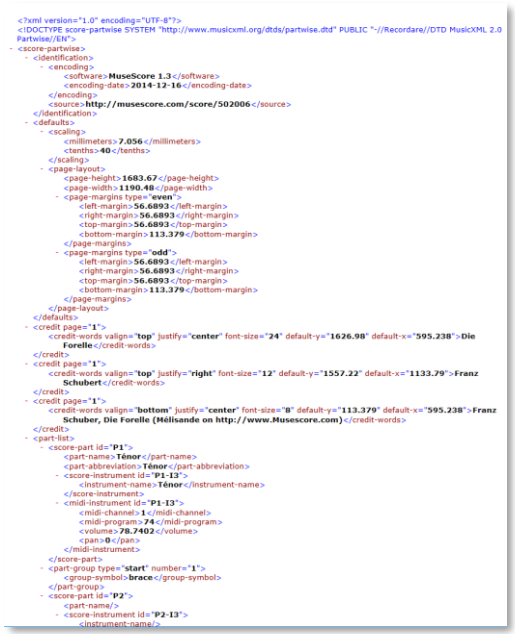
FRANZ SCHUBERT.

Erste Ausgabe.

Mässig.

Singstimme.

Pianoforte.

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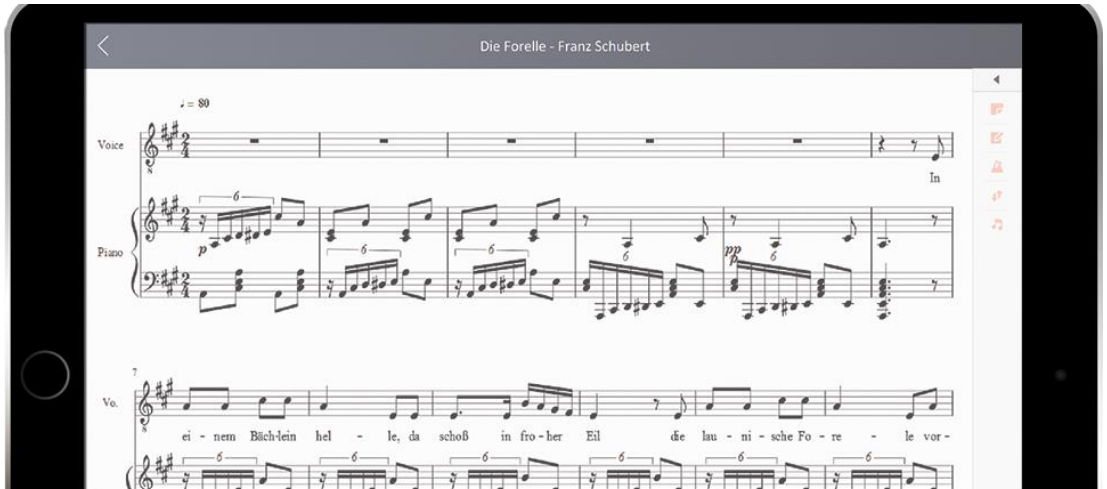

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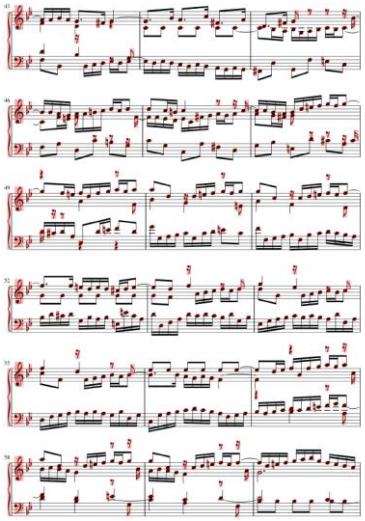
Music scanning – challenges & solutions



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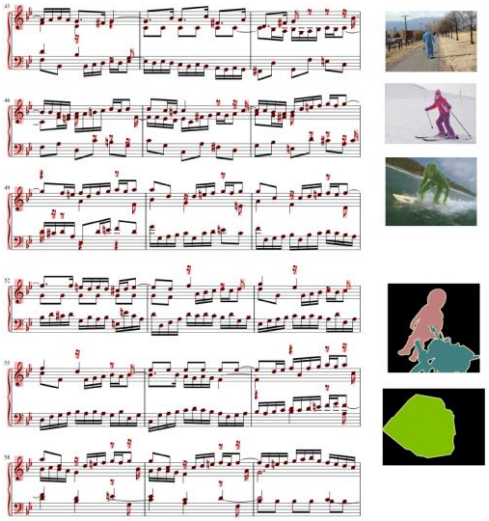

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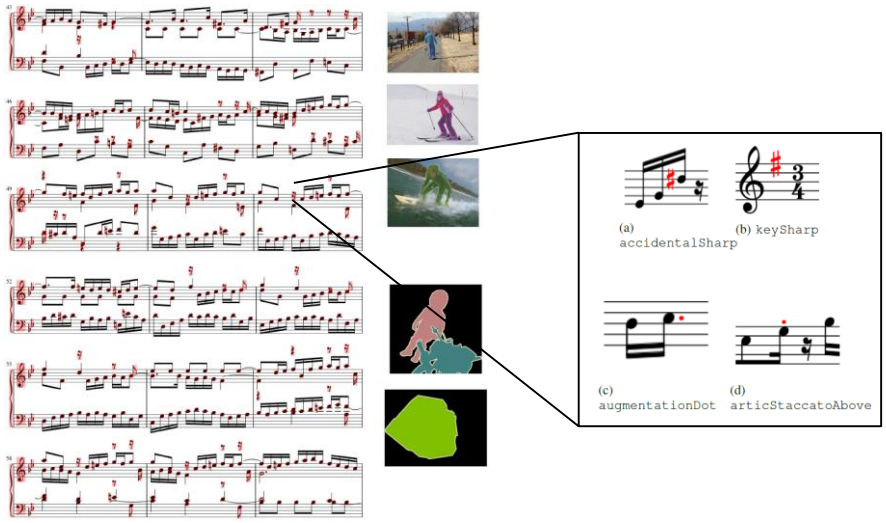

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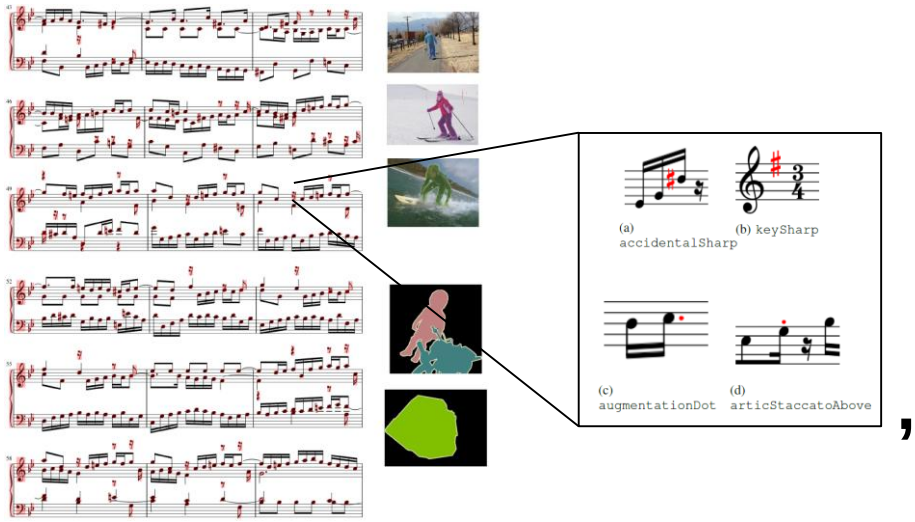

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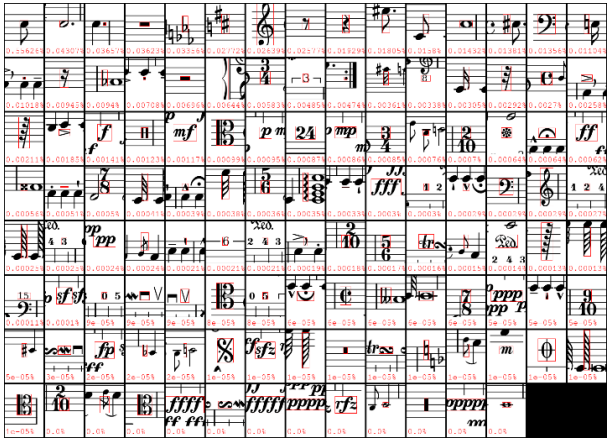

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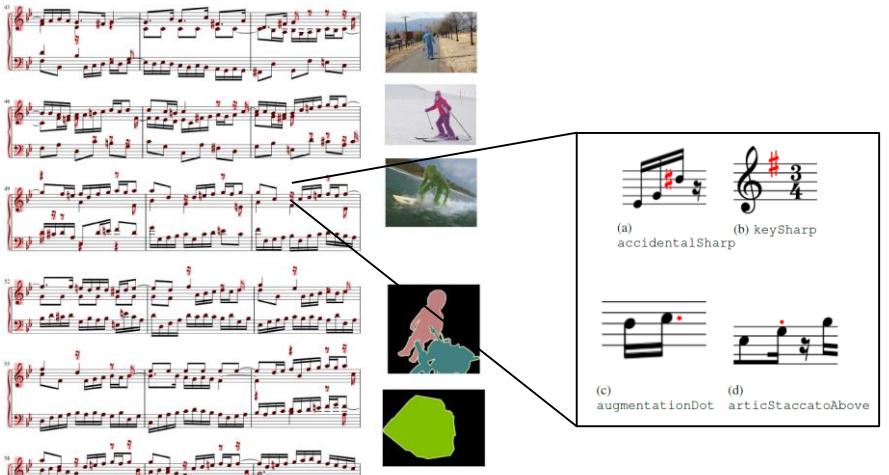

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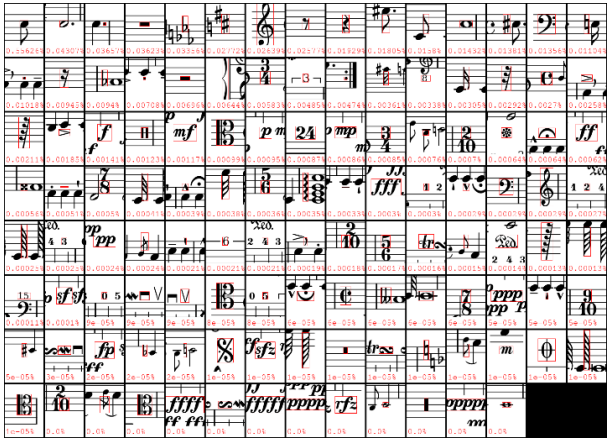

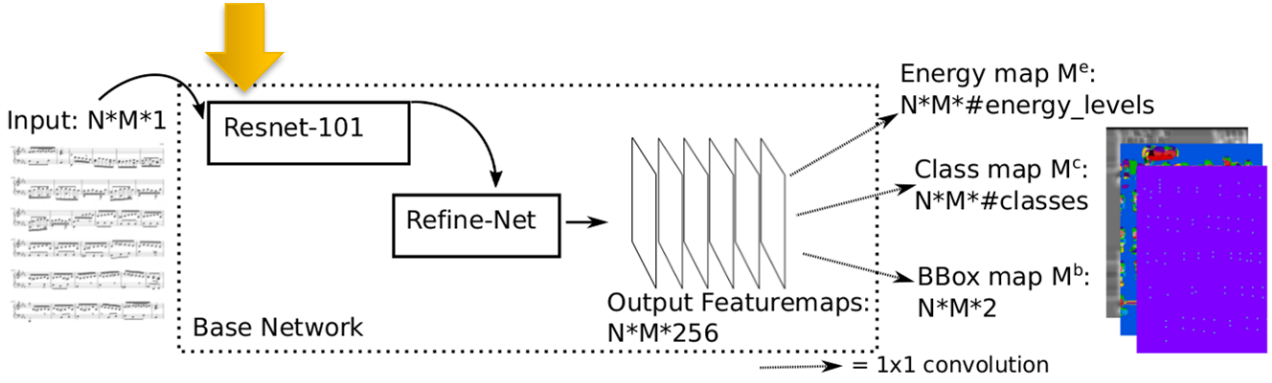

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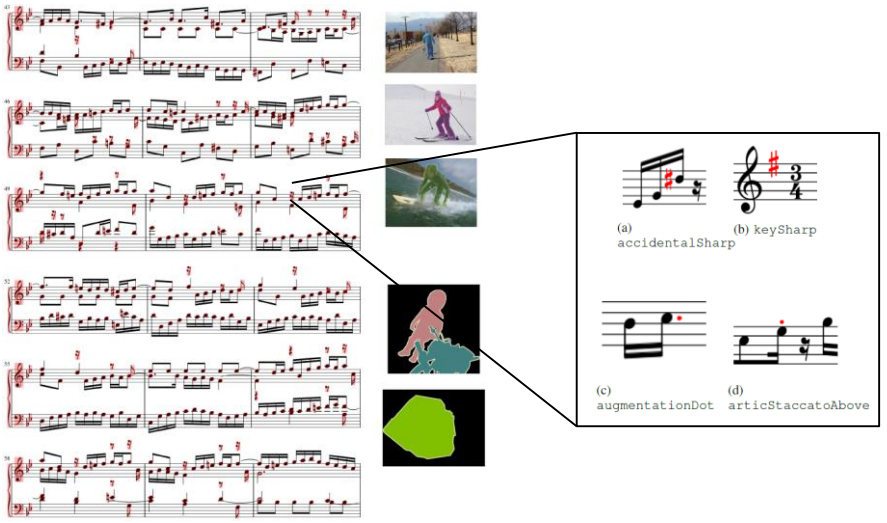

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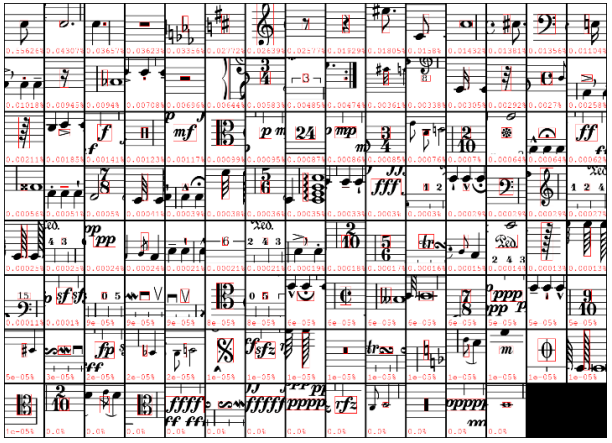

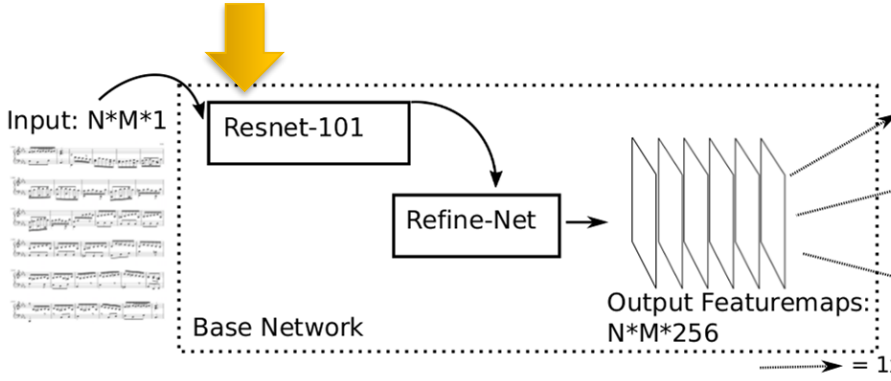

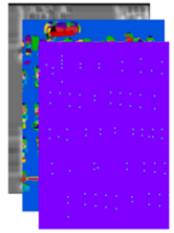

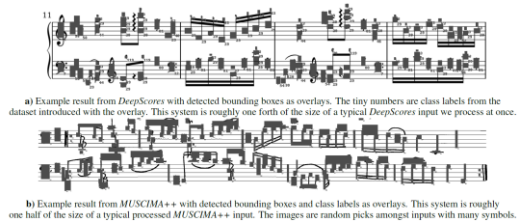

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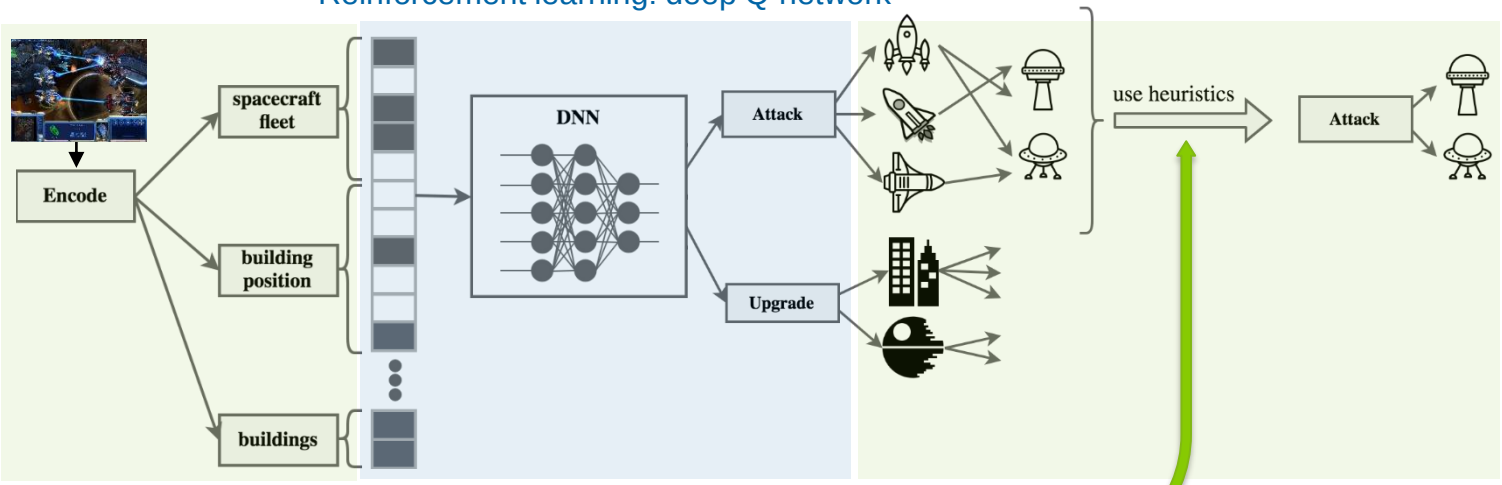
Game playing

(symbolic figure)

Game playing – challenges & solutions

Reinforcement learning: deep Q network



Large discrete action space → use heuristic

- makes exploration difficult
- elongates training time

Delayed and sparse reward → do reward shaping

- sequence of actions crucial to get a reward

Distance encoding → use reference points

Transfer Learning → difficult: more complex environment needs other action sequence

Stadelmann, Duivesteijn, Amirian, Tuggener, Elezi, Geiger & Rombach (2018). *«Deep Learning in the Wild»*. ANNPR'2018.

Lessons learned

Data is key.

- Many real-world projects miss the required **quantity & quality** of data
  → even though «big data» is not needed
- **Class imbalance** needs careful dealing
  → special loss, resampling (also in unorthodox ways)

Robustness is important.

- **Training processes** can be tricky, booth in deep- and reinforcement learning
  → give hints via a unique loss, reward shaping and preprocessing
- **Risk minimization** instead of error minimization
  → detect all defects at the expense lower precision



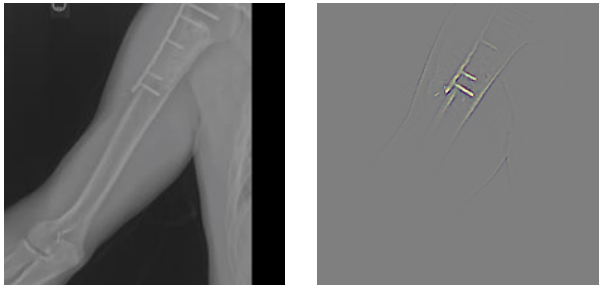

Lessons learned – model interpretability

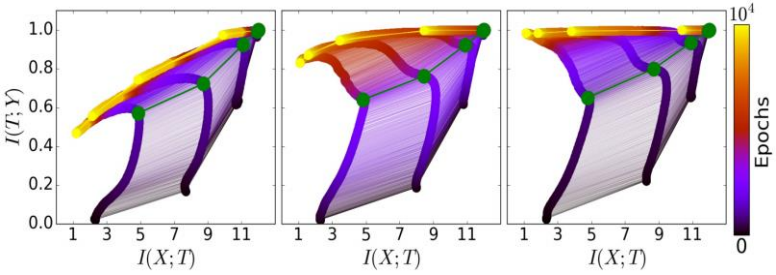
Interpretability is required.

- Helps the developer in «debugging», needed by the user to trust
  → visualizations of learned features, training process, learning curves etc. should be «always on»

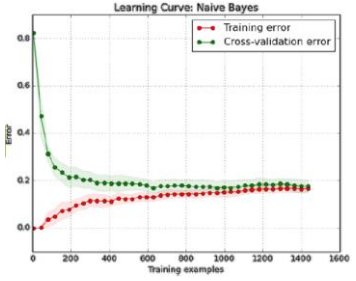
negative X-ray

positive X-ray

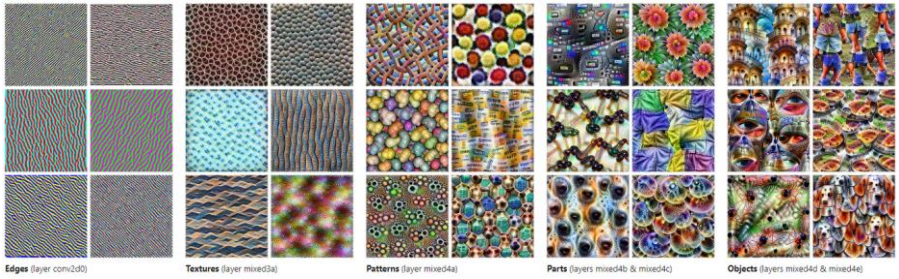




DNN training on the Information Plane



a learning curve



feature visualization

Schwartz-Ziv & Tishby (2017). *«Opening the Black Box of Deep Neural Networks via Information»*.
https://distill.pub/2017/feature-visualization/, https://stanfordmlgroup.github.io/competitions/mura/
Stadelmann, Duivesteijn, Amirian, Tuggener, Elezi, Geiger & Rombach (2018). *«Deep Learning in the Wild»*. ANNPR'2018.

Conclusions

- Deep learning **is applied** and deployed in «normal» businesses (non-AI, SME)
- It does not need big-, but some **data** (**effort usually underestimated**)
- DL/RL **training** for new use cases **can be tricky** (→ needs thorough experimentation)
- New **theory and visualizations** help to debug & understand
  → *the training process*
  → *individual results*

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- thilo.stadelmann@zhaw.ch
- 058 934 72 08
- https://stdm.github.io/

On the topics:
- AI: https://sgaico.swissinformatics.org/
- Data+Service Alliance: www.data-service-alliance.ch
- Collaboration: datalab@zhaw.ch

➔ Happy to answer questions & requets.