KNIME Deep Learning Workshop

Christian Dietz & Adrian Nembach
KNIME
Why Deep Learning

• Multi-layer neural networks for learning tasks on images, videos, text and sound
• Learns useful representations from raw data
• Extremely flexible: One framework for classification, regression and unsupervised learning
Outline of this Workshop

• Deep Learning in a Nutshell
• KNIME Deep Learning Integrations
• Use-cases
  – Image classification with Convolutional Neural Networks
  – Language modeling with Recurrent Neural Networks
  – Neural machine translation with Recurrent Neural Networks
Deep Learning in a Nutshell
Deep Learning in a Nutshell
Multi-Layer Neural Networks

Weights

Activation Function

\[ f(\sum x \cdot w) \]
Training of Deep Networks

Batch 1

Batch 2

Batch 3
Training of Deep Networks

Row 10 is a 3
Row 11 is a 5
...  
Correct?
Adjust weights.
KNIME Deep Learning Integrations
KNIME Deep Learning Integrations

• Keras
  – Network creation with KNIME nodes
  – Training with the Keras Network Learner node
  – Execution with the DL Executor node
  – Save and load with Keras Reader and Writer nodes

• TensorFlow
  – Creation and training with DL Python nodes
  – Conversion of trained Keras networks
  – Fast execution with the DL Executor node
  – Save and load with TensorFlow Reader and Writer nodes
KNIME Keras Integration
Use-Cases

Image classification

Language modeling

How are you?

Wie geht es dir?

Neural Machine Translation
Image Classification
Image Classification

- Task: Given an image predict a class label
- Supervised Learning
- Realized with Convolutional Neural Networks
Convolutional Neural Networks

• For high-dimensional inputs like images and video
• Replaces global matrix multiplication with local convolution
Possible Strategies

• Train CNN from scratch
• Fine-tune pre-trained CNN to the new task
  – VGG16, Inception, Resnet, …
• Use pre-trained CNN as feature extractor and build a different classifier on top
  – Native KNIME nodes, H2O, XGBoost, …
Deep Learning in Action
Language Modeling
Language Modeling

• Task: Given a sequence of characters predict which character is the next in the text
• Unsupervised Learning
• Realized with Recurrent Neural Networks
Recurrent Neural Networks

Useful for sequence data like text, time series, audio and video

MLP and CNN

Input

Output

RNN

Input 1

Input 2

Output 1

Output 2

State

...
Stacked RNNs
Language Modeling with RNNs
Deep Learning in Action
Neural Machine Translation
Neural Machine Translation

• Task: Given an English input sentence predict a German translation
• Supervised Learning
• Realized with Recurrent Encoder-Decoder networks

How are you? RNN Wie geht es dir?
Encoder-Decoder Networks

Useful for:

- Autoencoders
- Semantic segmentation
- Neural machine translation
Recurrent Encoder-Decoder Networks
Deep Learning in Action
Conclusion

Deep Learning in KNIME allows to

• create and train sophisticated Keras networks
• fine-tune pre-trained networks like Inception
• mix and match Keras and TensorFlow networks with other KNIME nodes and integrations
• Export the networks for deployment with other frameworks
Thank You for coming!
Questions?