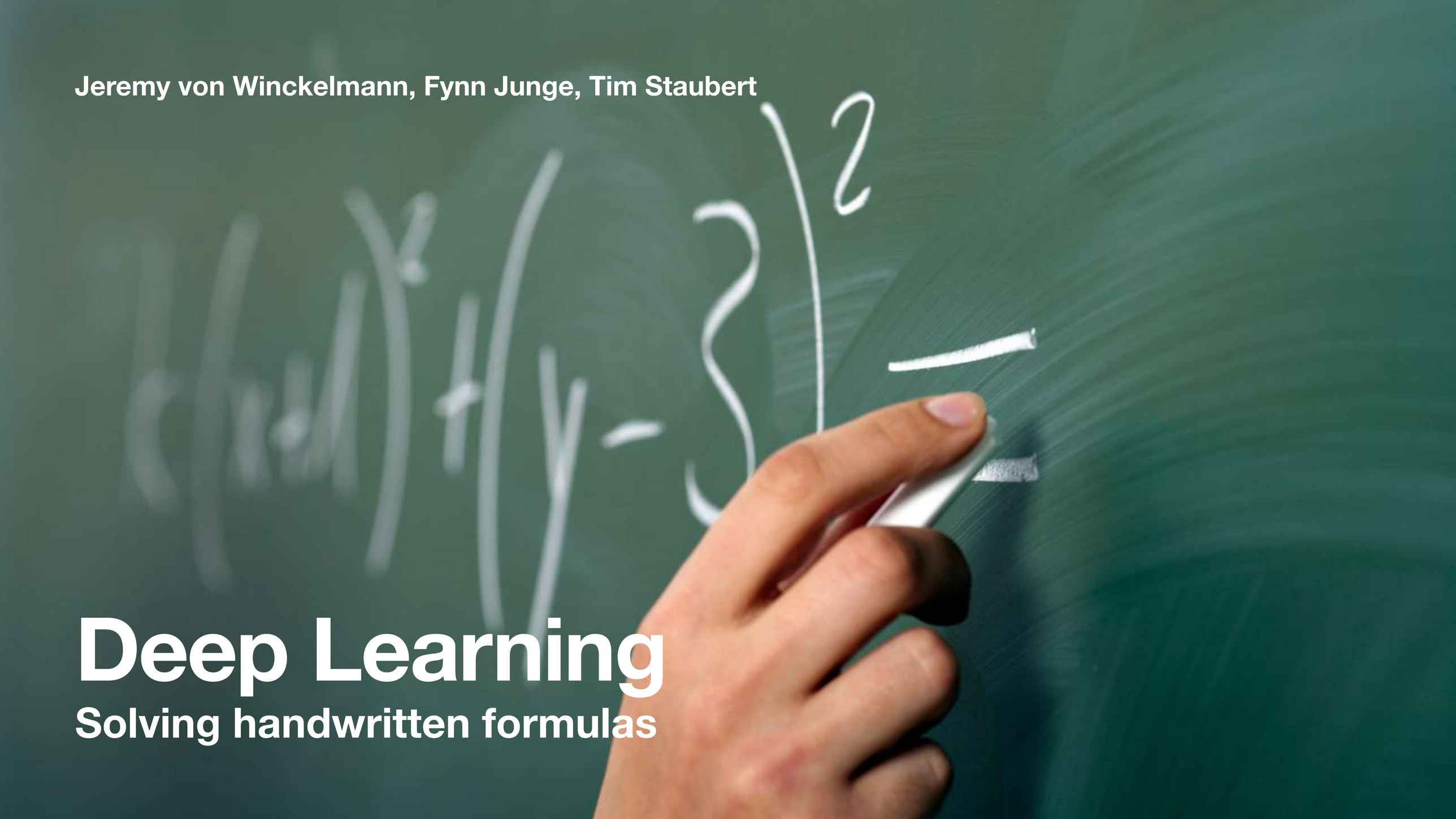
Jeremy von Winckelmann, Fynn Junge, Tim Staubert



Deep Learning

Solving handwritten formulas

„Why not create a neural net that is able to solve handwritten equations?“

Jeremy on Winckelmann

Motivation

Motivation

Why even bother?

- Automatic grading of math assignments in school
- Change calculator interfaces to written formulas instead of typed formulas
- Improve possibilities for digital bookkeeping
- …

Specification

Specification

What exactly do we want to do?

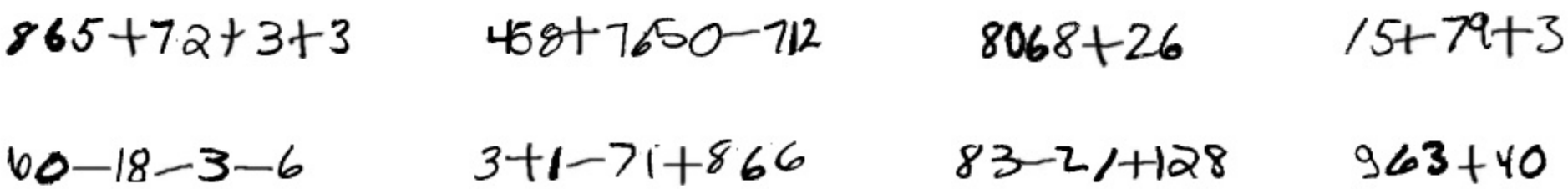
- Focus on equations consisting of numbers $n \in \mathbb{Z}$
- That are chained by the operations {+, -}
- Explore different approaches to solve the problem
- …

Training data

Training data

What data do we use for training?

- We created the formula images ourselves
- We use MNIST
- And the math symbols dataset from Kaggle*
- Variable padding left/right and top/bottom for each digit

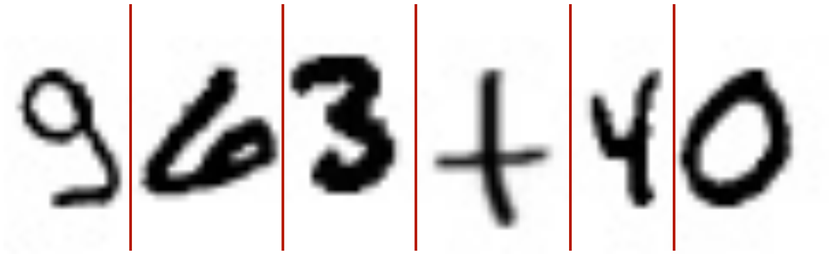


Methods

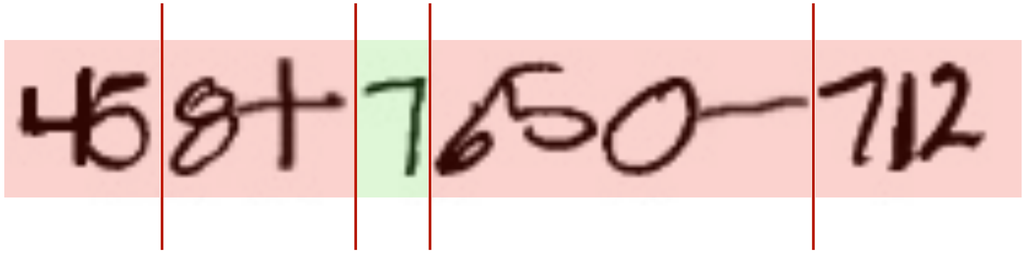
Methods

A very simple approach

- Split characters at vertical white lines
- *Then loop over all recognized characters*
- *Pad the characters to 64 x 64*



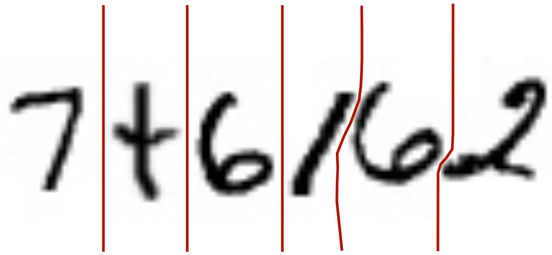
- Input the character into a CNN that was trained on MNIST and {+, -}
- *Join all network outputs*
- *Compute with Python*



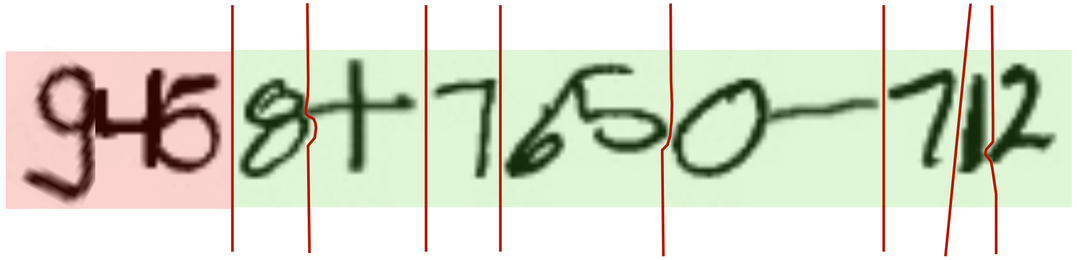
Methods

An improved, simple approach

- Split characters at wiggled white/grey lines



- *Then loop over all recognized characters*
- *Pad the characters to 64 x 64*
- Train the CNN on single characters and combinations of two characters
- Input the character(s) into a CNN that was trained on MNIST and {+, -}
- *Join all network outputs*
- *Compute with Python*



Methods

A sophisticated approach

- Look to Huggingface for help
- Finetune the trOCR* model on the self-created formulas
- Deploy the model

Live Demo