
Machine Learning Research Project

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Outline

- Topic & Research Question
 - Why?
- Methodology
 - Preprocessing
 - Machine Learning
- Results
- Discussion

Topic & Research Question

- *Current progress*

Topic

- Supervised Learning
 - Classification
 - Neural Networks & other ML models
- Handwriting Recognition
 - Letters → Words

Research Question

Which machine and deep learning model is the best at recognizing handwriting?

Why?

- Document Digitization
- Forensic Analysis
- Data Entry Automation



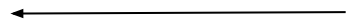
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Methodology

Preprocessing

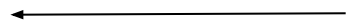
- Database
 - 200,000 pairs of words/digitized names

LENA



Ideal

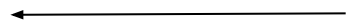
CLOTHES, MOBILE



Unusable

COLORED, CAR, CLOTHES, ETC.

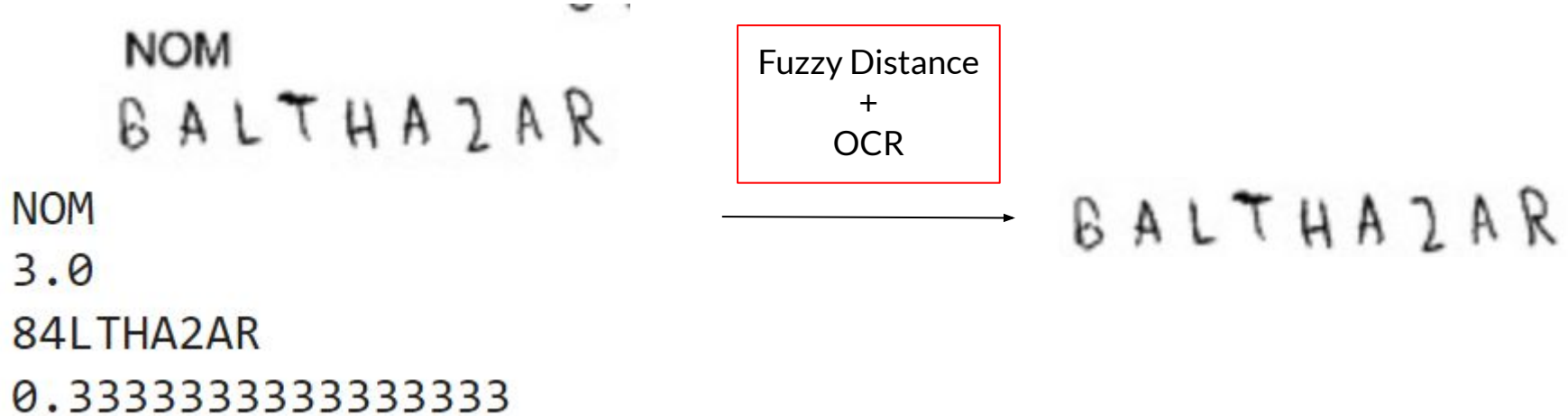
NOM: GORTCHAKOFF



Noise

Preprocessing

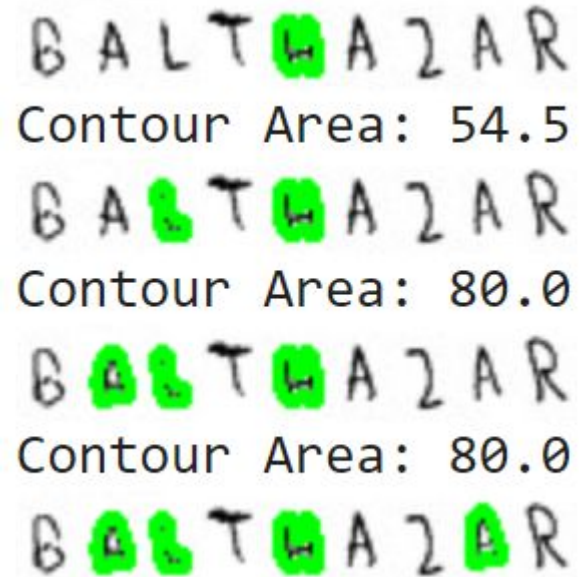
- Getting usable data (perfectly cut letters)



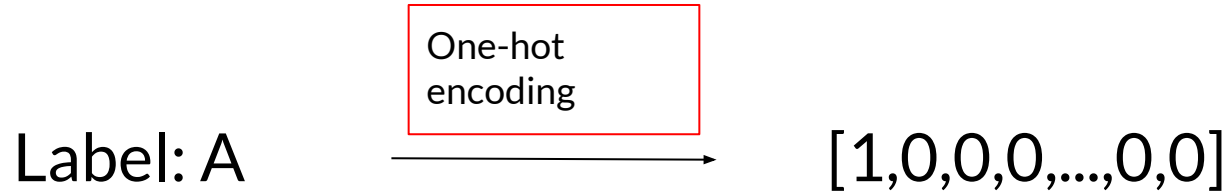
Preprocessing



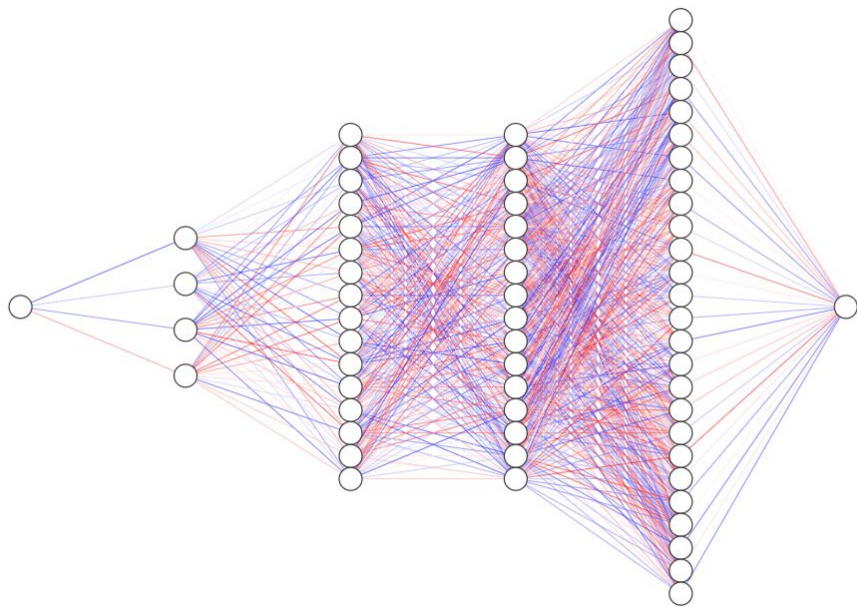
OpenCV
findContours()



Preprocessing



Machine Learning



Input Layer $\in \mathbb{R}^1$

Hidden Layer $\in \mathbb{R}^4$

Hidden Layer $\in \mathbb{R}^{16}$

Hidden Layer $\in \mathbb{R}^{16}$

Hidden Layer $\in \mathbb{R}^{26}$

Output Layer $\in \mathbb{R}^1$

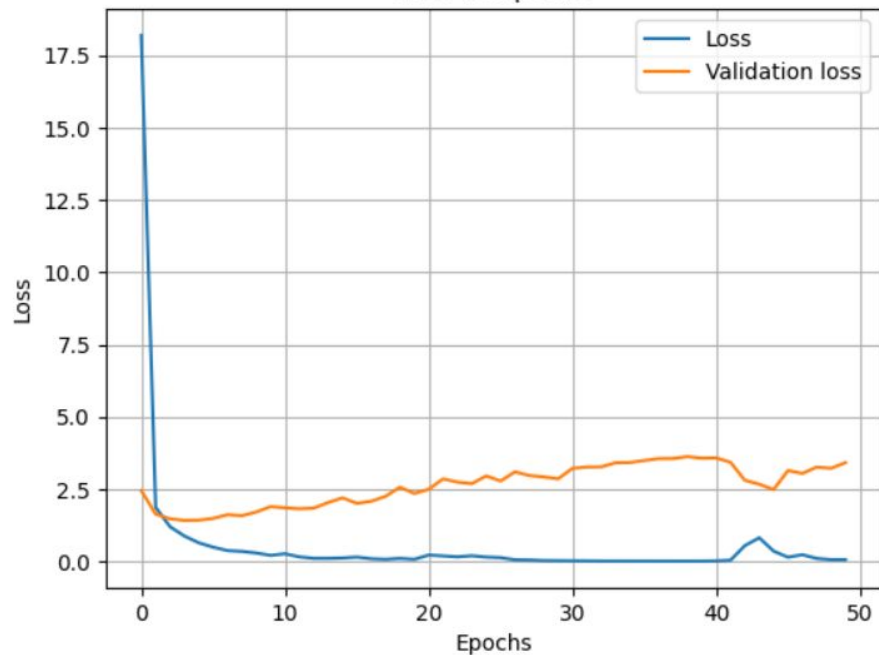
- 16 convolutional neurons
- Flatten
- 64 dense neurons
- 64 dense neurons
- 27 neurons (for each letter & "-")
- Output (argmax)

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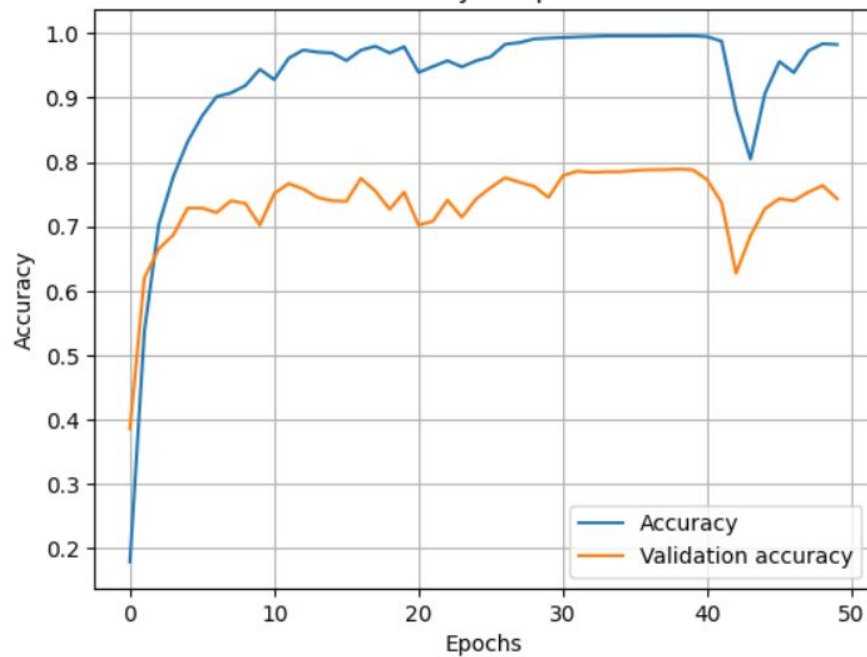
Results & Discussion

Results

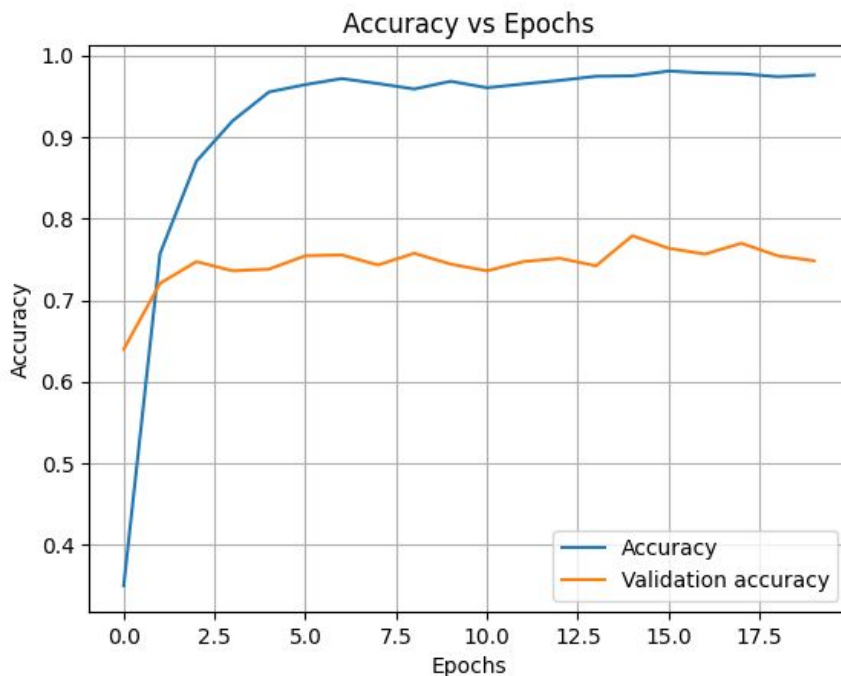
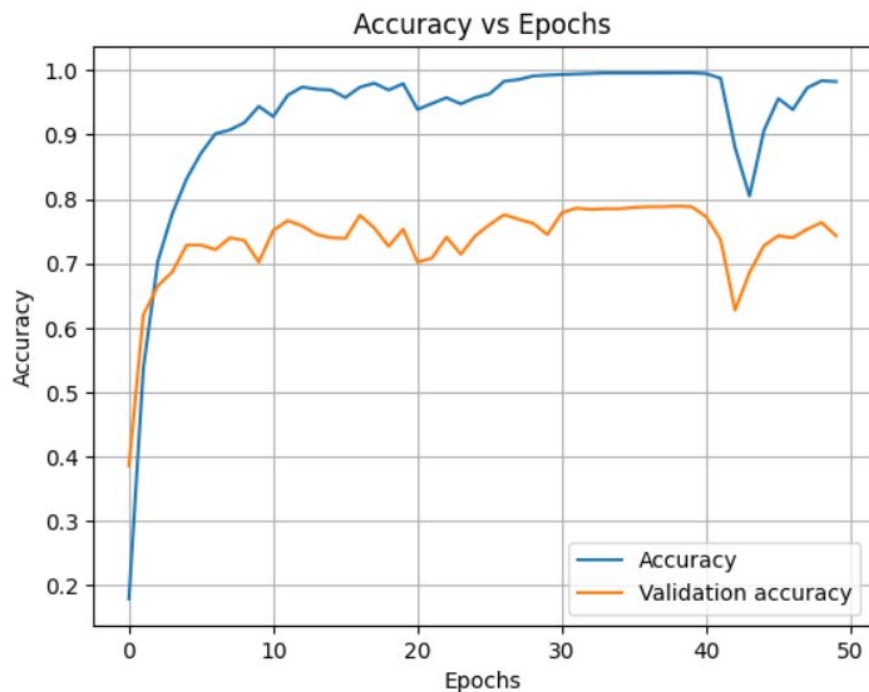
Loss vs Epochs



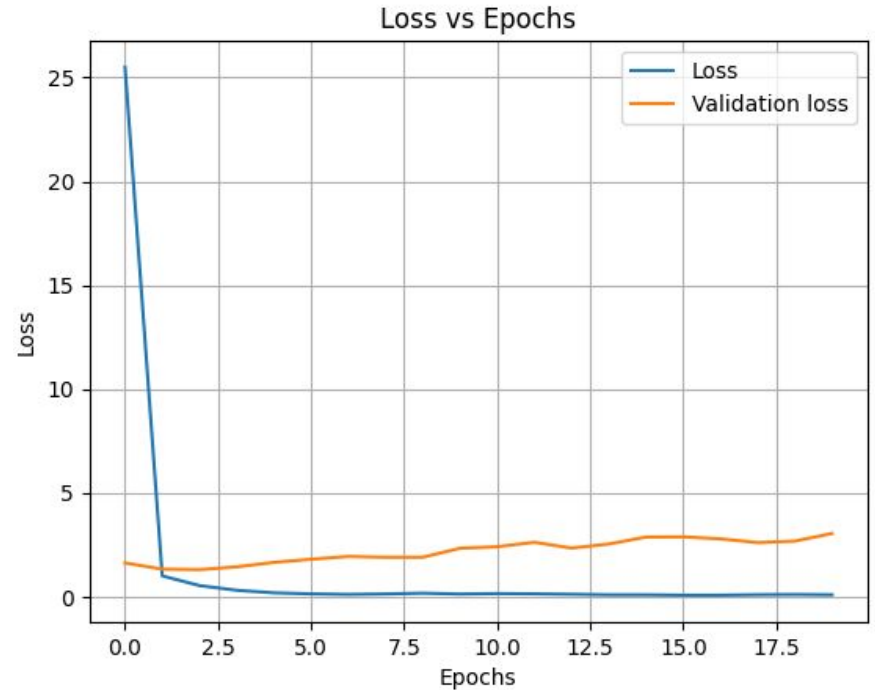
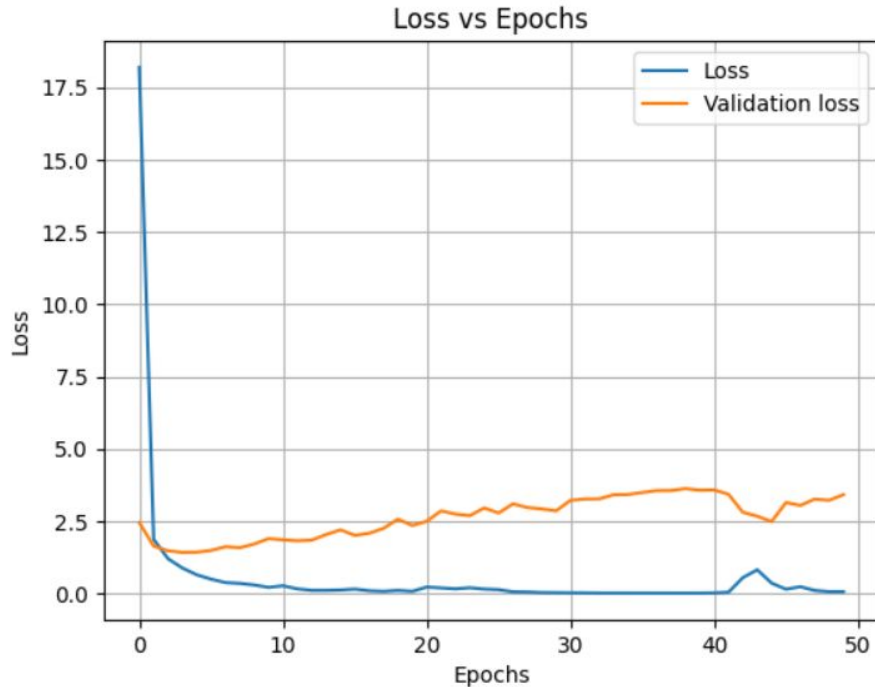
Accuracy vs Epochs



Results: Removing one Dense layer



Results: Removing one Dense layer



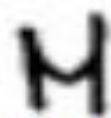
Results



Predicted: R
Actual: A



Predicted: R
Actual: A



Predicted: Y
Actual: M



Predicted: A
Actual: S

Discussion

- High accuracy
- Computation time
- Homogeneous data set
 - Preprocessing
- Further research
 - Data entry automation, digitalization