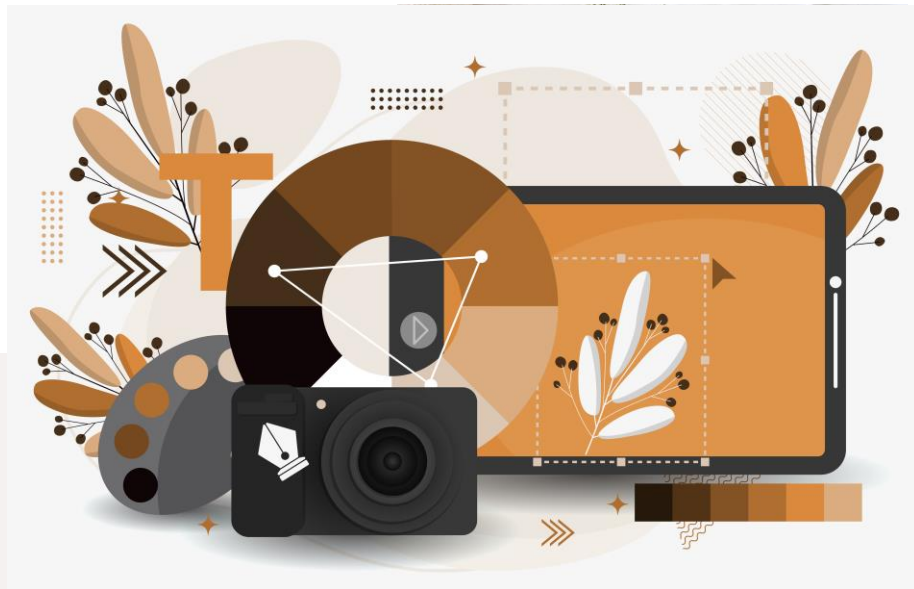# Preprocessing for Neural Network Image Classification

Special seminar to bachelor thesis

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Motivation

- Current Topics,

- forms basis for other Computer Vision problems,

- used in many areas (eg. Medical imaging)

Goals

1.

2.

3.

To review image classification tasks solved by neural networks, input datasets and preprocessing methods applied on images.

To propose and implement methods for image preprocessing with a goal to improve the accuracy of image classification on the specified task.
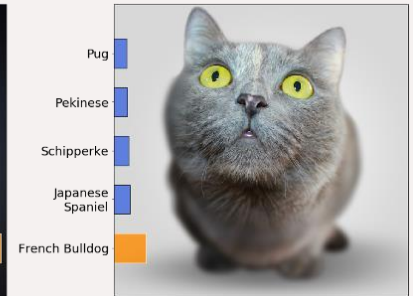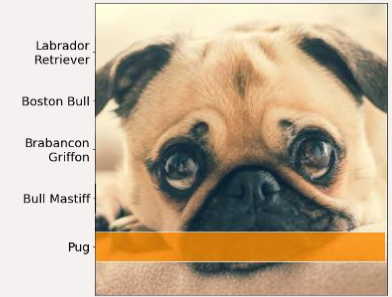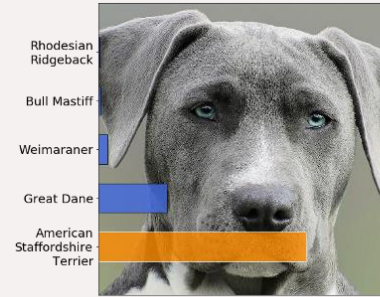
To evaluate the impact of proposed preprocessing methods on the selected neural network with focus on the classification accuracy.

Image Classification

▫ analyse an image and identify the "class"

▫ early Image Classification
   – relied on raw pixel data,

▫ Deep learning
   – using of neural networks CNN)

Image Classification

Supervised

- Previously classified reference samples,
- to create statistical measures.

Unsupervised

- Unlabled datasets,
- hidden patterns, data groups,
- pattern recognition and image clustering,
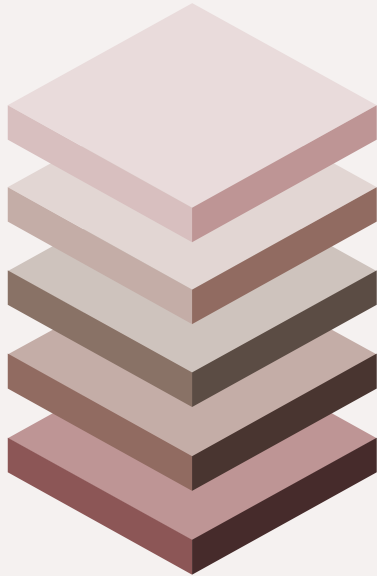- K-mean and ISODATA.

Art Image Classification

CNN

Styles of Art

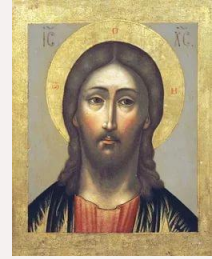Number of classes: 5

Dataset Analysis

1

Classes

Drawing

Engraving

Iconography

Painting

Sculpture

drawing

drawing

engraving

drawing

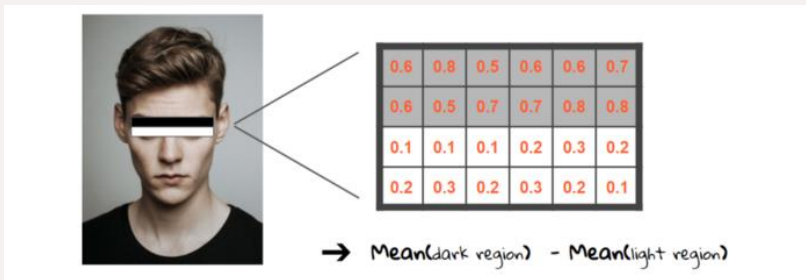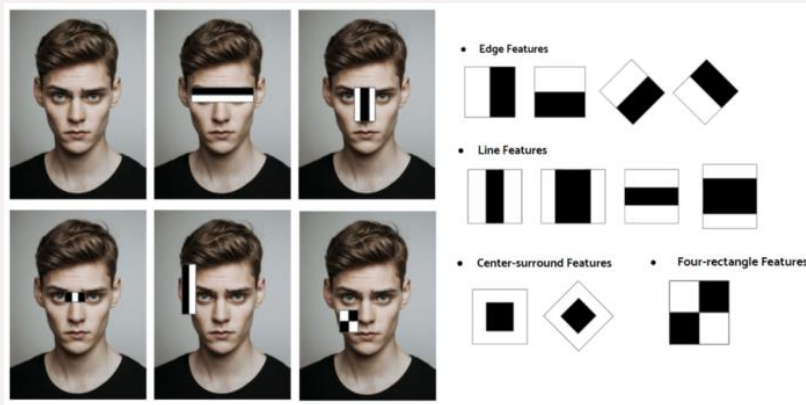engraving

Which is which

sculpture

Face detection

Haar Classifier

- Haar-features extraction,
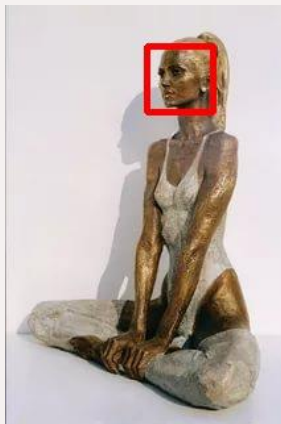- Integral Image,
- Adaboost,
- Cascade Classifiers.

Face detection

Haar Cascades
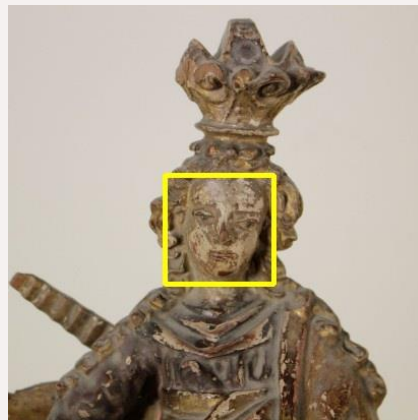- Frontal Face
- Profile Face

Test Accuracy

	CNN 1	*notes*
Original	77,45 %	
Grayscale	41,47 %	
Face detection	73,83 %	*Adjust the colour and the shape of frame,*
...	?	

Next Steps

Using other methods, filters

Different model
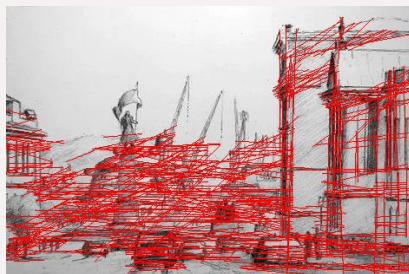
Dataset with larger number of classes (50<)
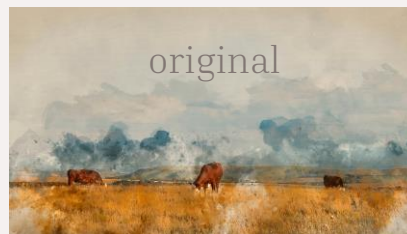
Other methods

Hough Line Transform

Detecting straight lines.

K-means

Clustering – unsupervised Learning algorithm, which groups data into different clusters.

original

K = 3   K = 5

Histogram equalisation

Image whitening

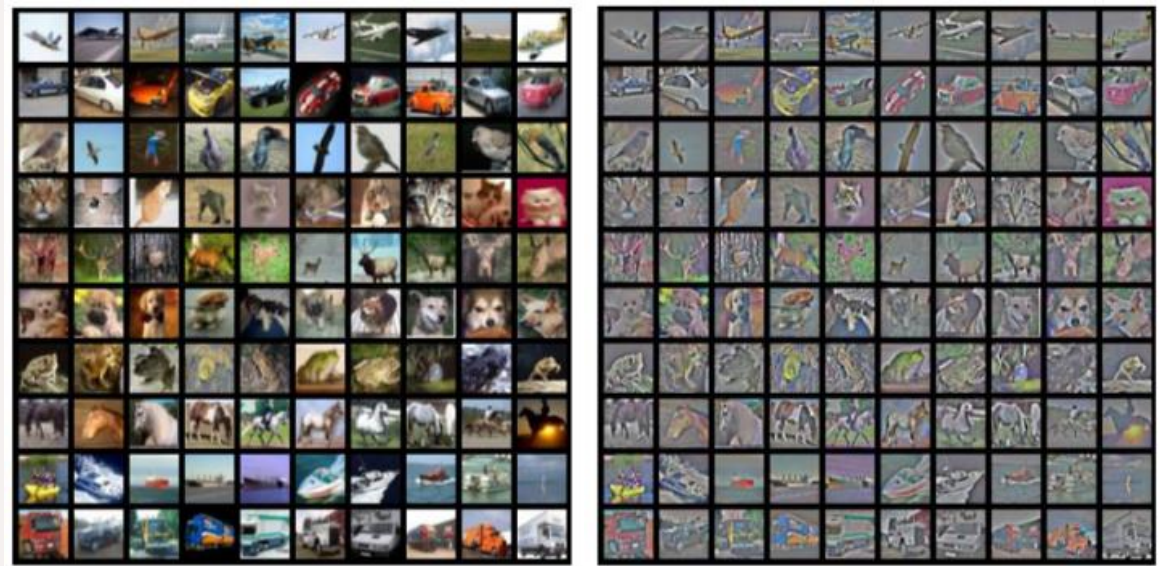Mean normalisation, standardisation, convariance matrix, …

Fig.1: 10 raw sample images from each of 10 different classes of CIFAR10 namely airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck

Recommended Literature

- **Bartl, V., Špaňhel, J. and Herout, A., 2022**. PersonGONE: Image inpainting for automated checkout solution. In _Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition_ (pp. 3115-3123).

- **Pal, K.K. and Sudeep, K.S., 2016, May**. Preprocessing for image classification by convolutional neural networks. In _2016 IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT)_ (pp. 1778-1781). IEEE.

- **Hurtik, P., Molek, V. and Hula, J., 2019**. Data preprocessing technique for neural networks based on image represented by a fuzzy function. _IEEE Transactions on Fuzzy Systems_, _28_(7), pp.1195-1204.

- **Rawat, W. and Wang, Z., 2017**. Deep convolutional neural networks for image classification: A comprehensive review. _Neural computation_, _29_(9), pp.2352-2449.

- **Szeliski, R., 2022**. _Computer vision: algorithms and applications_. Springer Nature.

Thank You!

Any Questions?