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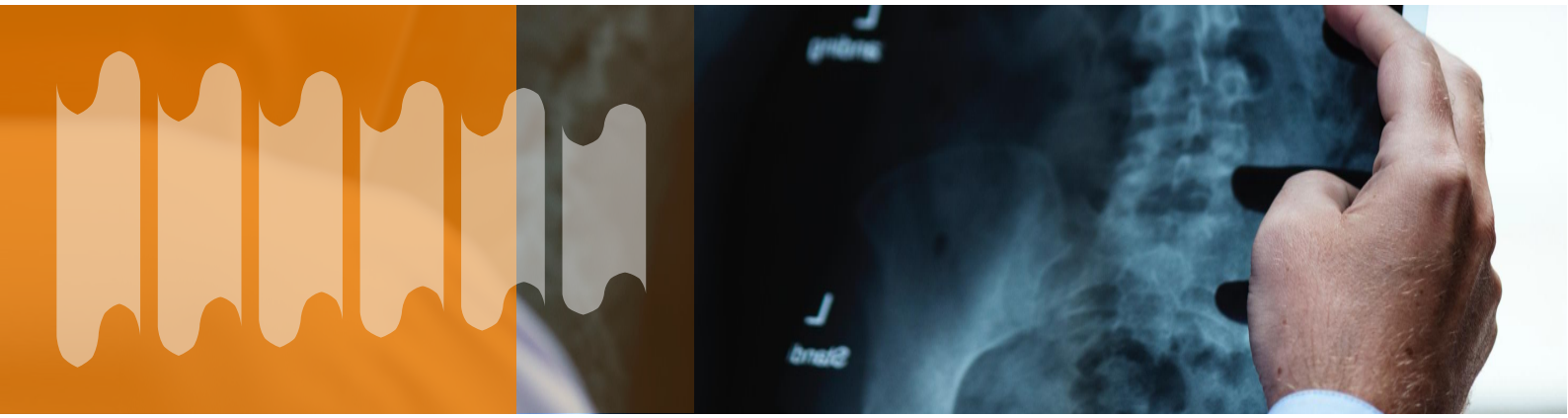


Deep Learning - Thorax X-ray Images

Project Goal

Aim of the project was the development of a computer-aided design algorithm (CAD) that identifies possible types of thoracic diseases in chest X-rays. Radiologists can therefore be supported in the X-ray based diagnostics of cancer and other diseases. The developed model highlights suspicious areas in the X-ray images and provides a classification for chest specific disease types.

Provided Data

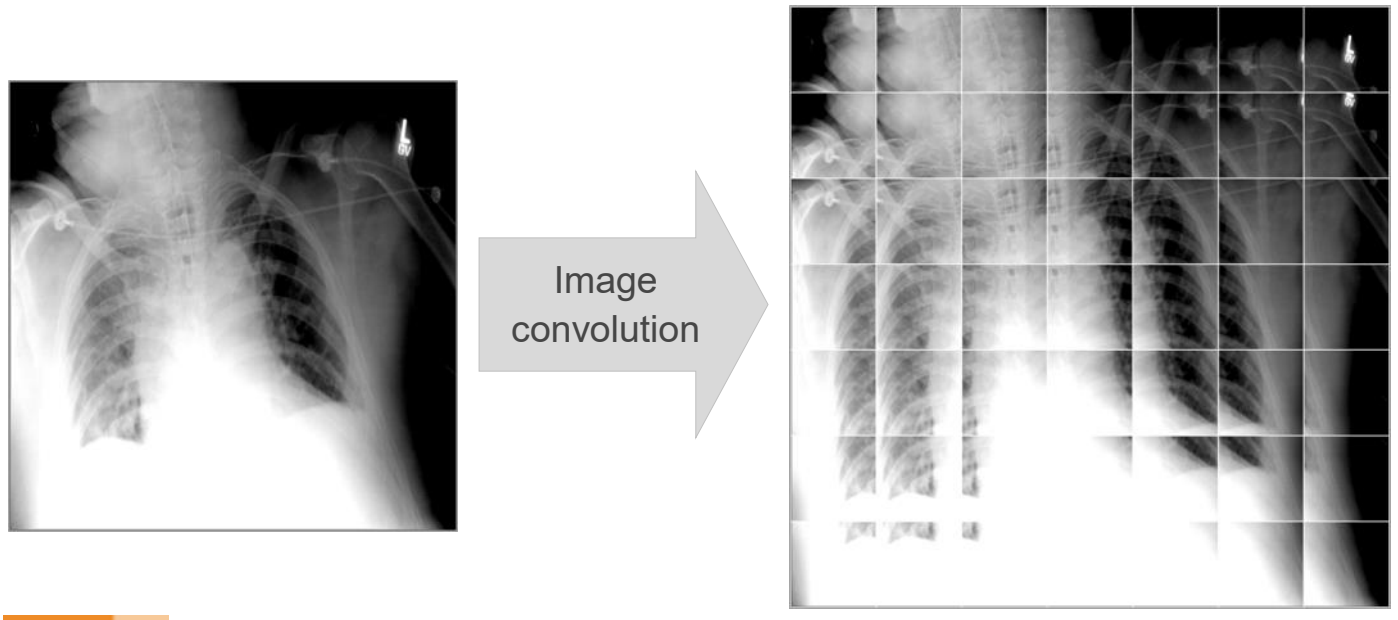
The project is based on a data set of 100,000 anonymized thorax X-ray images and the corresponding types of diagnoses.

Deep Learning and Image Processing

Processing the X-ray images occurred in 3 steps: image processing, feature processing and classification.

Image processing

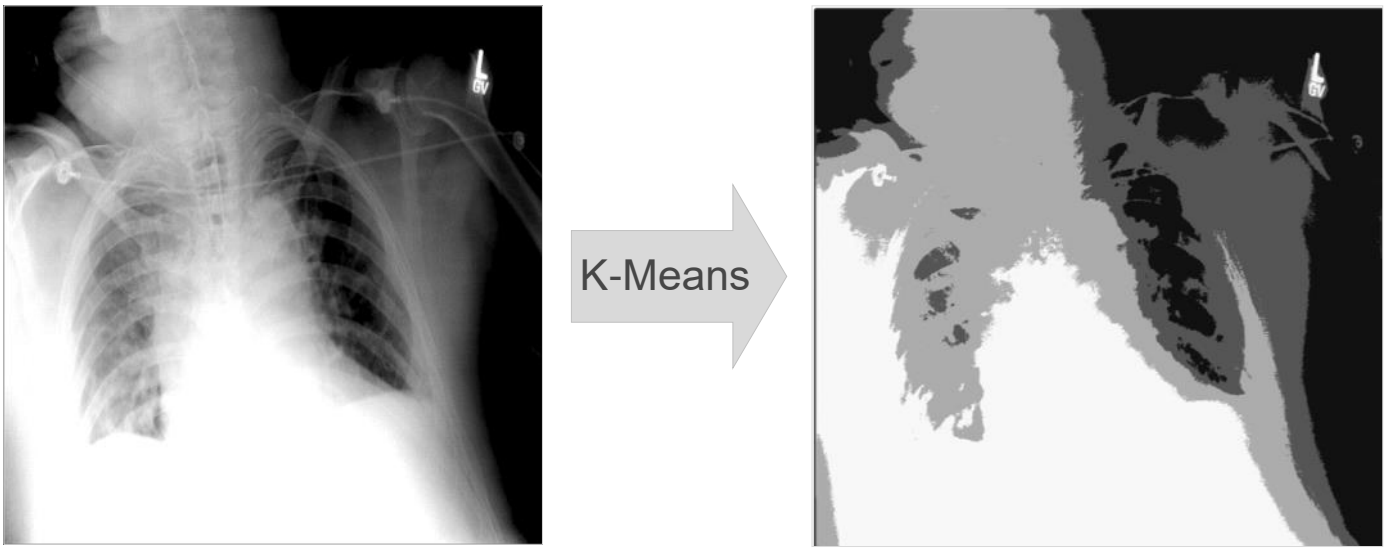
As a start, the x-ray images were processed by normalizing brightness and contrast. This was done to balance the differences within the X-ray image data set. Thereafter, contrast was increased to better highlight the suspicious areas in the images.



Feature Processing

Feature processing included an extraction and selection part. A K-Means algorithm was used to extract the essential features from the X-ray images. One application of this algorithm is to group images into multiple clusters, in this case based on color. This level of processing already provides valuable information and can support radiologists in identifying suspicious and possibly hidden areas.

The calculation of the K-Means clusters was configured to use 2 to 8 different colors. Each clustered image was then segmented recursively to assist the machine learning algorithms in extracting the features in suspicious areas.



Utilizing the extracted features, relevant characteristics like size, orientation, shape and location, could be mapped to the different types of diagnoses. This builds an ideal foundation to conduct diagnosis classification.

Classification

After extraction and selection of the important features of the X-ray images, Machine Learning Algorithms were trained. They recorded the suspicious areas in the X-ray images and assigned them to a type of diagnosis depending on particular characteristics. To select the best model and calibrate the corresponding parameters, 3-Fold Cross Validation was used. The best classification performance was achieved by the Convolutional Neural Network (CNN) using Multiple Image Convolution.

Project Goal

The Deep Learning and Image Processing Framework was developed and successfully applied in the X-ray data set, ready to support radiologists in identifying suspicious areas within thorax X-rays and support decision making in diagnostics.