

# KalligraphAI

## Generative Deep-Learning Model for Font Generation

### Graduate



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**Introduction:** In today's digital era, fonts play a central role in visual communication and design. This thesis investigates the application of generative deep learning models for the automatic creation of fonts. The aim of the thesis is to explore the possibilities and challenges of using Variational Autoencoders (VAEs) and Conditional Variational Autoencoders (CVAEs) for font generation.

**Approach:** The thesis first presents the theoretical foundations and previous approaches in the field of generative models and font generation. The methodology includes the implementation and training of several VAE and CVAE models with a special focus on metadata embedding and style transfer.

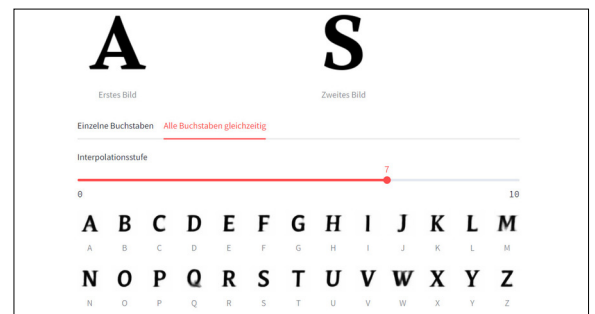
In the further course, an interface was developed that makes it possible to create complete fonts based on two given letters of a font by means of conditional generation by the CVAE. A latent vector is calculated for each of the two given characters, and ten interpolation steps are carried out between these vectors. Complete fonts can then be generated from the resulting interpolations. The tool offers the flexibility to select interpolated versions for each character individually or for the entire font.

**Result:** The results show that the CVAE is a promising architecture to generate stylistically customized fonts, while the VAE is mainly suitable for basic reconstructions. However, both architectures have difficulties in rendering small details such as serifs and thin lines. These weaknesses are due to the smooth embedding of the latent variables based on the Gaussian distribution. Even specific loss functions designed to penalize smooth transitions and force sharp edges could not overcome these limitations.

This research contributes to the further development of automated font creation and provides valuable insights into the application of deep learning for creative design processes.

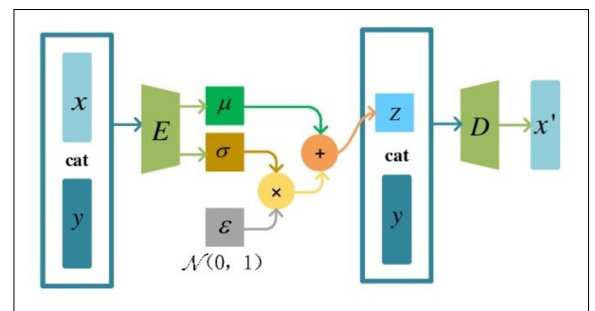
### User Interface for image interpolation

Own presentation



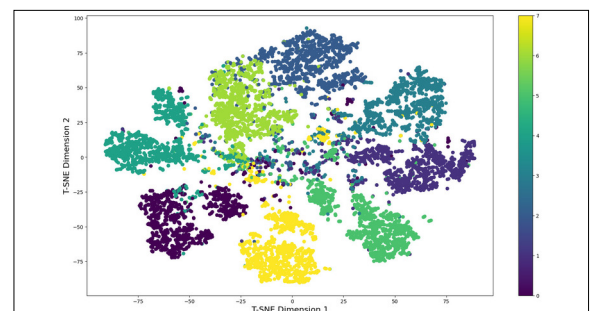
### Architecture of a Conditional Variational Autoencoder

Kim, H., & Park, M. (2023)



### Latent Space Embedding for A-D and a-d

Own presentation



### Advisor

Prof. Dr. Christoph Würsch

### Co-Examiner

Nicola Notari

### Subject Area

Computational Engineering