**MSc project: Learning distances with the triangle inequality from trajectories**

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Recently, Huang and Doebler (2024) investigated the recognition of handwritten digits from 0 to 9. The STKNet-approach first computes distance matrixes with the pointwise Euclidian distances of the points of the handwriting trajectories. Based on these matrices, a custom convolutional neural network architecture with a contrastive loss function finds distances between the trajectories. While working well in the downstream task of handwritten digit recognition, STKNet’s distances between trajectories do not satisfy the triangle inequality. As a consequence, the distances are not a metric. (Approximate) metrics are desirable for many purposes. For example, some clustering algorithms like k-Means, low-dimensional embeddings like multi-dimensional scaling (MDS) and many other methods relying on the geometric or topological structure all assume a metric.

In this project, the candidate will modify the contrastive loss function from Huang and Doebler, so that (approximately) the triangle inequality is satisfied by the learned distances. Some working knowledge of python is essential. The implementation of STKNet is in tensorflow and keras, so the candidate is expected to familiarize themselves with these packages. Substantial modifications for the new loss function(s) are part of this project.

**References**

Huang H., and Doebler, P. (September, 2024). Trajectory-based Handwriting Recognition via Spatiotemporal Convolution on Distance Matrix. AIPR. Xiamen, China.