Character-Level Arabic Sentiment Classification
via Neural SDE-Based Feature Dynamics

Abstract

This paper presents a character-level Arabic sentiment classification approach that combines convolutional neural networks (CNNs) with continuous-time stochastic differential equation (SDE) modeling. More precisely, the model encodes the input text at the character level using stacked CNN layers, followed by an SDE layer whose dynamics (drift and diffusion) are parameterized by end-to-end driven neural networks. Based on a large corpus of 330k reviews in Arabic, our CNN-SDE classifier achieves an accuracy of 87.51 and solid results in macro-F1, matching or exceeding the performance of proven reference architectures, and offering competitive performance with transformer-based models like AraBERT in the same experimental setting. We provide a detailed analysis of the model's robustness to different random initializations, metrics by class, and present a visualization of the learned latent stochastic dynamics.

Our experiments demonstrate the effectiveness of CNN-SDE formulation at the character level to process noisy and ambiguous text, and we discuss future directions of research in continuous-time sequence modeling by neural networks.