

Abstract: Time Matters

Handling Spatio-temporal Perfusion Information for Automated Treatment in Cerebral Ischemia Scoring

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Although video classification is a well addressed task in computer vision (CV), corresponding CV methods have so far only rarely been translated to the automatic assessment of X-ray digital subtraction angiography (DSA) imaging. We demonstrate the feasibility of a respective method translation by making the first attempt on automatic treatment in cerebral ischemia (TICI) scoring. [1] In a clinical setting, the TICI score is used to evaluate the initial as well as the perfusion state after thrombectomy, i.e. the intervention success. Therefore, a medical expert assigns a TICI score based on the observed perfusion in the spatio-temporal DSA image information. This process is, however, known to be time consuming and subject to a high inter- and intrarater variability, making its application cumbersome in large clinical trials. Due to the complex data and perfusion dynamics, automatic TICI scoring has, for a long time, been considered beyond the scope of machine (deep) learning. In the present work, we create a first benchmark for automated TICI scoring. The backbone of our method is formed by a two-arm image encoder and a gated recurrent unit (GRU) architecture, combined with a custom loss function that reflects the high label uncertainty and ordinality of the TICI score. Furthermore, framewise pseudo-perfusion labels are generated and used as framewise annotations in addition to the expert TICI annotation during the GRU training. By increasing robustness and physiological plausibility of the training process, we achieve differences between predicted TICI scores and annotations in the order of literature-reported interrater variability of human experts during test time.

References

1. Nielsen M, Waldmann M, Sentker T, et al. Time matters: handling spatio-temporal perfusion information for automated TICI scoring. Proc MICCAI. 2020;part 1:86–96.