



Global-Local Processing in Convolutional Neural Networks

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Abstract

Convolutional Neural Networks (CNNs) have achieved outstanding performance on visual processing problems. Actually, CNNs inspired by the typically developed human brain structures perform at the micro-level (Artificial neurons). At the same time, they are moving in the opposite direction in the macro architectures (high-level cognition), similar to autistic ones. Recently it has been investigated that CNNs are highly biased toward the local features and fail to detect the global aspects of their input. Nevertheless, the literature offers limited clues on this problem. To this end, we propose a simple yet effective solution inspired by the unconscious behavior of the human pupil. We devise a simple module called Global Advantage Stream (GAS) to learn and capture the holistic features of input samples (i.e., the global features). Then, inspired by the subconscious function of the human pupil following Global Precedence Effect (GPE) in cognitive psychology, the GAS network can combine with a CNN network as a plug-and-play component called the Global/Local Processing (GLP) model. The experimental results confirm that this stream improves the accuracy with an insignificant additional computational/temporal load and makes the network more robust to adversarial attacks. Furthermore, investigating the interpretation of the model shows that it learns a more holistic representation similar to the perceptual system of healthy humans.

Biography

Zahra Rezvani is currently postdoctoral researcher at IPM, computer science department, artificial intelligence lab. She is graduated with PhD of cognitive modelling from Shahid Beheshti university. She received her MSc and BSc in computer science from there as well. Her research interests include customized machine learning techniques, smart deep learning, social network analysis, and human visual perception modelling.

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