Rufin VanRullen - Brain-inspired multimodal deep learning

In our chair, we aimed to design novel deep neural network architectures by drawing inspiration from cognitive neuroscience. One example is the addition of feedback connections implementing «predictive coding» principles into standard convolutional neural networks: this makes the systems more robust to noise or adversarial perturbations, and can also render them susceptible to perceptual illusions--just like real brains. Another example is the design of multimodal (e.g. text+image) architectures following the «Global Workspace» theory of cognitive science. The independent modalities converge onto a common representation space (the global workspace), and the shared information is then broadcast back towards the entire system. Such an architecture provides a form of referential meaning or «grounding» to each unimodal system. In addition, the broadcast mechanism can be trained with unsupervised cycle-consistency objectives, which makes such systems particularly attractive compared with state-of-the-art models trained on billions of paired data samples (e.g. text+image).