Deep Neural Networks and Visual Processing in the Rat

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Submitter Kasper Vinken

Affiliation KU Leuven

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Presentation Abstract Summary The increased use of rodents as a model for low- and higher-level visual functions has raised the question of how rodent visual processing compares to existing computational and primate models. Rodent visual cortex has two pathways, with one “lateral stream” anatomically resembling the primate ventral stream (Wang, Sporns, & Burkhalter, 2012). This primate pathway is specialized in object recognition and the stages of processing are captured well by deep neural networks (DNNs; Güçlü & van Gerven, 2015). Here we compare the stages of processing of natural and scrambled movies in a 3D convolutional network (3D ConvNet) with three stages of the aforementioned rat lateral stream: primary visual (V1), laterointermediate (LI), and temporal occipital cortex (TO). As in rats (Vinken et al., 2016), a natural versus scrambled representation emerges in the convolutional layers of the DNN. The last of these layers can support generalization in a movie categorization task that rats could also learn (Vinken, Vermaercke, & Op de Beeck, 2014). The subsequent fully connected layers lead to a clear categorical representation not found in untrained rats (Vinken et al., 2016). This comparison reveals similarities between the rat lateral stream and a DNN that could explain relatively complex visual abilities.

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Co-author Information

* Presenting Author

First Name	Last Name	Affiliation	E-mail
Kasper *	Vinken *	KU Leuven	kasper.vinken@kuleuven.be
Hans	Op de Beeck	KU Leuven	hans.opdebeeck@kuleuven.be

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