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**Understanding human vision through Deep Learning**

**1.5 Million ERC Starting Grant for scientist of Osnabrück University**

OSNABRUECK.- By adapting techniques from the domain of artificial intelligence, such as deep learning, cognitive scientists from Osnabrück will study the core principles of human vision over the next five years. Professor Dr. Tim Kietzmann, who specializes in neuro-inspired Machine Learning, has been awarded the prestigious ERC Starting Grant of the European Union for his interdisciplinary project "TIME - Towards a dynamic account of natural vision" (1.5 million euros).

"This ERC-funded project is about the fundamental question of how our brain processes visual information," explains Tim Kietzmann, who is currently transitioning from the Donders Institute in the Netherlands to the Institute of Cognitive Science at Osnabrück University with his research group. "In vision, various processes naturally intertwine, rendering things complicated and exciting at the same time. With this project, we would like to take a closer look at this fascinating process: seeing involves information sampling via eye-movements and cortical filtering, information extraction, and information integration across space and time. All of these things happen in parallel within the fraction of a second across a large variety of brain areas. That is, the brain not only deciphers what it is that it is seeing, but at the same time decides when and where to look next to gather further information. To better understand these interrelated processes, we will combine high-resolution measurements of brain waves during natural vision, and analyze these data using machine learning techniques and simulate them in large-scale computational models. The cognitive science department at Osnabrück is the ideal place for this research!"

A central aspect of the ERC funded project, TIME, is to interpret human vision not as a largely independent cascade of processing steps from retinal signals to higher-level categorical information, but rather as an integrated process in which eye-movement planning, information extraction, and decision making operate jointly across time and space. "A dynamic approach allows us to look at human vision in a much more natural way than before. For example, our new developments enable us to include eye movements and the associated decision-making processes as part of the models," Kietzmann notes.

As computational models of visual brain function, Prof. Kietzmann will make extensive use of a machine learning technique, known as deep neural networks, which enable him and his team to run large-scale simulations on high-performance GPU compute clusters. In particular, the models are trained on and tested against large amounts of brain data, as obtained via high-resolution neuroimaging. The resulting biologically-informed computational models are expected to lead to a variety of insights and developments in multiple fields, explains Kietzmann: "We hope the ERC grant will not only provide a better understanding of human vision, but will provide fundamental insights into cortical information processing, as well as more efficient, robust, self-learning artificial intelligence and computer vision systems."

Tim Kietzmann, previously Associate Principal Investigator at the Donders Institute for Brain, Cognition and Behavior at Radboud University in the Netherlands, has recently accepted a Full Professorship for Machine Learning in Osnabrück. This new professorship is jointly funded by the district of Osnabrück, the city of Osnabrück, IHK Osnabrück - Emsland - Grafschaft Bentheim, Kampmann GmbH & Co. KG, Schoeller GmbH, Krone GmbH & Co. KG and the Georgsmarienhütte Foundation.

For Kietzmann, this marks a return to the city where he once completed his bachelor's and master's degrees, and later earned his PhD in close collaboration with the Vanderbilt Vision Research Centre in the United States. After his time in Osnabrück, he moved to the University of Cambridge, where he took on a group leader position for several years. Subsequently, he was appointed tenured Assistant Professor at the Donders Institute. Now, after many years abroad, he and his team return to Osnabrück. Kietzmann's research focuses on the interdisciplinary development of neuroscience-inspired machine learning methods to gain insights into cortical function, and to derive more robust, self-learning and continuously adapting artificial intelligence systems.

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