

## Sensors and Signal Processing of Biosignals in Project 3DNeuron

**Abstract:** The technological aim of the project 3DNeuroN has been to develop a 3D environment for seeding neuronal cells under natural conditions as possible. To cultivate the neurons in vitro and to measure their electric activity while growing, it was necessary to develop a 3D microsensor array. The electrodes must not have galvanic contact with the neurons because of electrode voltage. Galvanic passivation was required. Hence we constructed capacitive sensors by electrical insulation of that metallic electrodes. Because of technological constraints development of in-situ analog and digital chips as front end on the sensors was necessary. In the first version of the 3D sensor array, we built 800 channels simultaneously sampling into 10 data streams. The following signal processing methods had to clear the local 3D activity of neurons based on the spatiotemporal analysis of received data. For this, we developed new techniques and adapted known signal processing algorithms. After this measurement phase, we added the technological option to stimulate the neurons through the same sensors. We converted the sensors partly to actors simultaneously.

**Short CV:** Peter HUSAR (SM '98) was born in Zilina, Slovakia, in 1956. He received the Dipl.-Ing. degree, the Dr.-Ing. degree (Ph.D.), and the habilitation degree (postdoc thesis) from the Ilmenau University of Technology, Ilmenau, Germany, in 1980, 1986, and 1999, respectively. From 1986 to 1989, he was with the Research Institute for Computer Engineering, Zilina, Slovakia, and with Siemens, Erlangen, Germany. From 1992 to 2005, he was a Researcher and Assistant Professor in biosignal processing, measurement technology, and sensor development at TU Ilmenau. From 2005 to 2006, he was with the University Clinics of Saarland, Germany, as the Head of the Medical Technology Center. From 2006–2007, he was a Professor of biomedical engineering at the University of Applied Sciences of Anhalt, Germany. Since 2007, he has been the Head of the Department of Biosignal Processing at TU Ilmenau. From 2010 to 2018, he also has been the Head of the Bio-inspired Processing Group at the Fraunhofer Institute for Digital Media Technology, Ilmenau, Germany. He has authored numerous publications in his research fields and several patents. Dr. Husar is a member of several expert groups and a senior member of the IEEE Engineering in Medicine and Biology Society.

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