Alex Rubinov Memorial Oration 2021

Alzheimer's Disease:
New Approach for Early Indication by Voxel-(C)MARS – Optimization and Operational Research in Big-Data of us Humans

Professor Gerhard-Wilhelm Weber

Abstract:

In the first part of this lecture, we will tell in a "nutshell" where *Inverse Problems* come from, what they are and how they are approached. We will do this by a few questions from different beautiful areas of life. The main and second part of this lecture will demonstrate a powerful application of the Theory of Inverse Problems along with advanced Statistics, Data Science, Machine Learning, Operational Research, Artificial Intelligence, Biomedical Engineering, Neuroscience and its Big-Data, namely for an improved "early indication" of the dementia disease which we call as *"Alzheimer's"*. We shall present some quite diverse views on this dangerous illness. The methods of *MARS* and our own version of *CMARS*, notably by addressing the units of *"Voxels"* in the brain, have led to very good results. Of course, in our lecture to the honor of **Professor Alexander Rubinov**, Mathematics and Optimization will always play a special role. In the third part of this lecture we will shortly move from human *brain* to *heart* and discuss our selected problem of medical imaging there as well. For both brain and heart we will look at the inverse and the corresponding *forward problem* of "generation". We shall pursue and overcome this dichotomy in our lastly mentioned challenge, namely how mathematics, algorithms and computational machines can support us in the creation of *art*. We shall mainly refer to the *"Marbling Arts"*, notably *"Ebru"*. With our lecture we strive to create "appetite" in order to study more, to study and find out more, to create and invent more, and to collaborate and enjoy together more. During the lecture we shall discuss some newest models in physics and biology, cosmology and generalized space-time research, with beauty and wonders of the smallest and the biggest and including the "spirit". For our whole agenda we will need you - our friends and the young generation.

7:00 pm
Thursday 9 December
via MS Teams

Each year a public oration is held to commemorate the life of Professor Alexander Rubinov and to celebrate his contribution to Federation University as founding Director of the Centre for Informatics and Applied Optimisation.

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Biography: Professor Gerhard-Wilhelm Weber was born in Bad Berleburg, Westphalia, Germany. He is a Professor of Operations Research at Poznan University of Technology, Poland. Professor Weber held teaching and research positions at universities in Germany and Turkey. His expertise covers a wide range of areas in Optimisation, Operations Research and their applications. He has made strong contributions to these areas including semi-infinite optimisation, supply chain management, machine learning and applications of mathematical methods in medicine. Professor Weber has heavily involved in organisation of many conferences in optimisation and operations research. Most notable among them are EURO Conference on Operational Research and Conferences of International Federation of Operations Research Societies (IFORS). Professor Weber was awarded IFORS Fellow 2021.