Förderprogramm: Hochschulkooperationen mit dem „African Institute for Mathematical Sciences (AIMS)“ in Südafrika, Kamerun, Ghana

Projekttitel: Non-Negative Structured Regression with Applications in Communication and Data Science

Kooperationspartner: Technical University of Berlin (Projektverantwortlich), AIMS South Africa (Dr. Bubacarr Bah)

Projektverantwortliche: Prof. Giuseppe Caire und Dr. Peter Jung

Kurzbeschreibung des Projekts:

In this project we propose to design efficient algorithms for the reconstruction of redundant-encoded signals in wireless communication and network properties in data science. The main motivation of this line of work comes from model-based compressed sensing (CS) with non-negativity priors. CS is based on the fact that the intrinsic dimension of many digital signals or large data sets is typically far less than their ambient dimensions, for example the sparse representation of images, videos, audio data, network status information like activity and novel coding techniques for wireless communication. Traditionally, redundancy and structure in the data is exploited after the acquisition (measurement), which may be very costly in terms storage and bandwidth. CS instead attempts to overcome this by performing sampling and compression simultaneously, i.e., acquisition from a sub-Nyquist perspective. CS works well with provable guarantees for dense matrices. However, in communication engineering and data science problems related to complex networks structured sparse matrices are used due to more efficient storage and processing. Therefore, we focus also on binary and sparse matrices, formed for example by sampling Hadamard matrices, expander matrices, etc. For such type of matrices CS often reduces to linear sketching, which has been applied in data streaming, and graph sketching. Furthermore, sparsity and compressibility can be regarded as first order structure of signals and objects of interest. In practice, most objects of interest exhibit second other structures like block-sparsity, tree-sparsity, non-negativity, etc. Both, the communication and complex networks problems we consider have often a conic constraint like non-negativity, hence the title of the project.

Links:

https://www.commit.tu-berlin.de/menue/research/current_projects/non_negative_structured_regression/parameter/en/