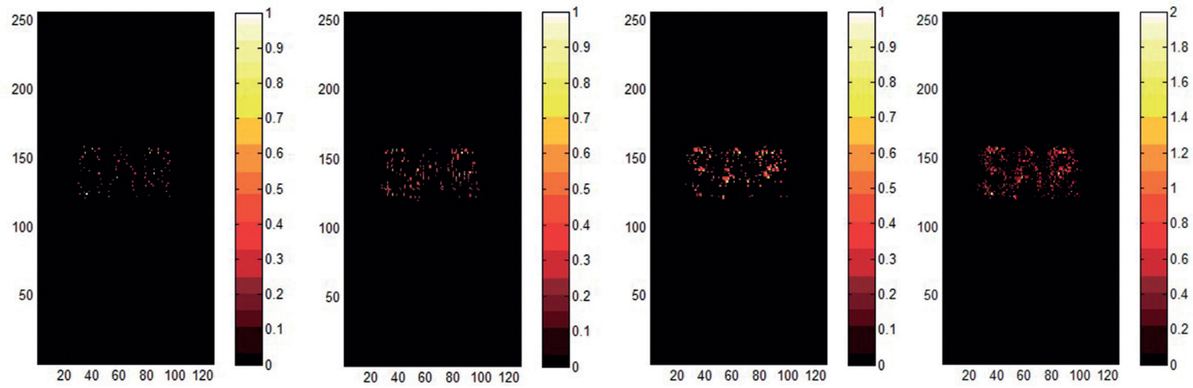
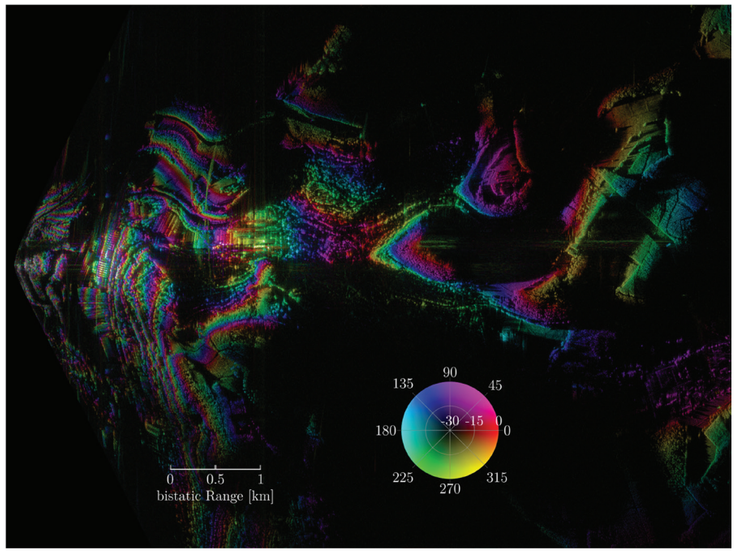
ComSAR - Compressive Sensing (CS) methods applied to Synthetic Aperture Radar

Compressive Sensing (CS) methods applied to Synthetic Aperture Radar (SAR) one the one hand promise the reduction of raw data rates and quantity without losing any information concerning the final result (this was the principal paradigm and main direction of CS in the beginning), but more importantly, and this is the driver and motivation of this research proposal, it enables the development of new methods of information retrieval. State-of-the-art are first published CS approaches to radar imaging, particularly for the imaging of small objects (ISAR, Spotlight), but as well for the special case of SAR- tomography. However, CS-SAR is far from being generally understood concerning its possibilities and even farther away from being an operational or mature processing approach in comparison with classical algorithms. The works of this project proposal aim at filling this apparent gap. The goal of the applicants, both well known experts in radar imaging and CS applications, is to systematically research sparsity issues in SAR-data and to exploit sparse models or combinations of sparse models to generate SAR images of superior quality. Rather than using CS for reducing the number of measurements, they intend to use the non reduced data set to increase the resolution, giving rise to super resolution. A further main aspect is the utilization of complementary overcomplete dictionaries for the identification of different scattering mechanisms and different scene characteristics as initial point for a novel form of content classification and information retrieval. The third research goal aims at the development of CS techniques for 3D-imaging with planar real and/or synthetic apertures, especially with respect to material penetrating radar, with applications for ground penetrating radar (GPR) and subsurface imaging, with impacts on quality control up to clinical diagnostics.



CS reconstruction results of simulated SAR data by assuming that (a) the scene is sparse in space domain; (b) the scene is sparse in wavelet domain; (c) the scene is sparse in Gradient domain. (d) The image formed as the union the maximum values of of (a), (b) (c) at each pixel.



Interferometric SAR image (radar intensity and interfer-ometric phase) of Dreis-Tiefenbach/Siegen acquired by the HITCHHIKER system in 2009.and 2014

I Project Management and Execution

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