Workshop "Computational Sensorics“ dd. 28th – 30th October, 2015

	Wednesday, 28th October, 2015
11:30 – 11:45	Welcome **Prof. Dr. Otmar Loffeld**
11:45 – 12:45	**„Non-smooth Convex Optimization for Computer Vision“** **Abstract:** In this talk, we propose and analyze a flexible and efficient first- order primal-dual algorithm that is particularly suitable for solving large-scale non-smooth convex optimization problems. The algorithm comes along with guaranteed convergence rates, which are known to be optimal for first-order methods. A further advantage of the algorithm is, that it can be efficiently parallelized on graphics processing units, hence allows to solve some problems even in real-time. We will show applications to several computer vision problems ranging from optical flow estimation to 3D reconstruction. Speaker: **Prof. Dr. Thomas Pock**, TU Graz Discussion (15 min.) Location: **PB-H 0103**
12:45 – 13:45	Internal Talks Location: **PB-H 210**
13:45	Lunch
14:30	Technical Tour Laboratories ZESS
16:30	End of Meeting

	Thursday, 29th October, 2015
10:00 – 10:15	Opening **Prof. Dr. Otmar Loffeld**
10:15 – 11:15	**"Computational Radar Imaging: A Sparse Signal Representation Perspective"** In this talk we first present an overview of several lines of inquiry in which we have been involved and that lie at the intersection of two domains: sparse signal representation and computational radar imaging, in particular synthetic aperture radar (SAR) image formation. This historical overview contains (i) analysis and synthesis-based sparse signal representation formulations for SAR image formation together with the associated imaging results; (ii) sparsity-based methods for wide-angle SAR imaging and anisotropy characterization; (iii) sparsity-based methods for joint imaging and autofocusing from data with phase errors; (iv) techniques for exploiting sparsity for SAR imaging of scenes containing moving objects, and (v) compressed sensing-based analysis and design of SAR sensing missions. Next, we describe more recent work together with our perspective for future research in this domain. Specific points of discussion and challenges posed will include reducing computational complexity and performing distributed processing, establishing stronger connections between imaging and decision-making, using effective machine learning ideas to tune the notion of sparsity to a particular context, and going beyond sparsity to exploit other forms of simple structures present in the data as well. Keynote-Speaker: **Prof. Dr. Mujdat Cetin**, Sabanci University, Turkey Discussion (15 min.) Location: **PB-H 0103**
11:15 – 12:15	**"On the Algorithmic Core of Multifunctional Multisensorics – Methodological Aspects and Advanced Applications"** **Abstract:** Sensor Data Fusion is the process of combining incomplete and imperfect pieces of mutually complementary sensor information on various levels in such a way that a better understanding of an underlying real-world phenomenon is achieved. Typically, this insight is either unobtainable otherwise or a fusion result exceeds what can be produced from a single sensor output in accuracy, reliability, or cost. Appropriate collection and sensor resources management, sensor registration and alignment, stochastic filtering, data association, logical analysis, space-time integration, exploitation of redundancies, quantitative evaluation, and appropriate visualization are part of Sensor Data Fusion as well as the integration of related non-sensor context information. The talk will address the algorithmic core of exploiting multifunctional sensors and networks of distributed sensor networks. We will try to provide a relatively comprehensive overview of state-of-the-art methodologies on different levels of processing, from signals to more condensed informational entities, such as plots, tracks, classification results, and multiple object vignettes. This selection will reflect the author's personal point of view and will be illustrated by examples from his own research and ongoing projects in his department. Under the headline of "Computational Sensorics inspired by Computational Physics" highly

	promising future trends will be sketched. Due to the increasing availability of inexpensive, but powerful sensor and ITC technology, sensor data fusion rapidly emancipates from its roots in defense applications. “Computational sensorics”, an emerging and more comprehensive branch of engineering science to be defined and developed properly, will become a key technology driver for numerous innovations changing modern societies and industries. The talk will thus conclude with a preliminary strategy of how this enormous potential may cooperatively be exploited by using top resources at Siegen University and institutions that are already cooperating with it or those that should so in future. Speaker: **Prof. Dr. Wolfgang Koch**, Fraunhofer FKIE, Bonn Discussion (15 min.) Location: **PB-H 0103**
12:15	Lunch
13:30 – 14:30	**“Through-the-Wall Radar Imaging"** **Abstract**: Through-the-Wall Radar Imaging (TWRI) is an emerging technology, allowing to “see” through visually opaque material such as walls. It has numerous civilian, law enforcement and military applications making it a highly desirable tool in, for example, police and firefighter missions or search and rescue operations. TWRI can be used to detect buried people after natural disasters, e.g. earthquakes. It allows police units to detect and locate hostages, hostage-takers and weapons in a hostage crisis before even entering the building and allows to detect and classify concealed weapons and explosives in military actions or for homeland security purposes. In all these applications, it is the ultimate aim to use radio frequency (RF) emission and reception to gain vision into scenes which otherwise are nonaccessible physically, optically, acoustically, or thermally. This talk will mostly focus on the generation of TWRI images using a technique called Compressive Sensing (CS). CS allows to significantly reduce the number of sensors and/or frequency bins required to detect targets. Besides the actual generation of images, also their automatic interpretation through detection and classification algorithms will be tackled. Speaker: **Dr.-Ing. Christian Debes**, TU Darmstadt Discussion (15 min.) Location: **PB-H 0103**

	<u>Internal Talks</u>	<u>Laboratories ZESS</u>
14:30 – 15:30	Dr. Koch	Dr. Debus
15:30 – 16:30	Dr. Debus	Dr. Koch
16.30	End of Meeting	

	Friday, 30th October, 2015
10:00 – 10:15	Welcome **Prof. Dr. Otmar Loffeld**
10:15 – 11:15	**To be defined**