RESEARCH GROUPS 2014–2017

Biomimetics and Intelligent Systems (BISG)

The Biomimetics and Intelligent Systems Group (BISG) is a fusion of expertise from the fields of computer science and biology. In BISG, our bread and butter is intelligent systems, and our research areas include data mining, machine learning, robotics, and information security. More precise research topics vary from data mining algorithm development and optimization of industrial manufacturing processes all the way to environmental monitoring with mobile robots. In addition to the group's long term research strands, it also aims to provide concrete new openings for the purpose of reacting to fundamentals and novelties to integrate better ICT and biotechnology/biomedicine. The rapid development of ICT and Bio has opened up new unexpected ways to achieve better and concrete synergies and integration of these research fields.

Biomedical Engineering (BME)

The mission of the Biomedical Engineering Group (BME) is to carry out top-level basic, applied and translational research in biomedical engineering. The aim is to develop, apply and evaluate novel biomedical measurement technologies in health and wellbeing. The research is interdisciplinary, and focuses on measurement problems with the cardiovascular system, central nervous system, respiratory system and musculoskeletal system, together with applications in biomedicine and eHealth. The research profile is based on linking information technology and medicine, with an aim to utilize methodologies of information engineering, signal and image processing, pattern recognition, biophysics, medical imaging, applied mathematics, simulation, biomedicine and clinical medicine. BME has strong national and international collaborative networks, including partners in the USA, Japan and many European universities.

Center for Machine Vision Research (CMV)

The mission of the Center for Machine Vision Research (CMV) is to develop novel computer vision methods and technologies that create the basis for emerging innovative applications. CMV plans to carry out well focused cutting-edge research, for example, on novel image and video descriptors, perceptual interfaces for face to face interaction, multimodal analysis of emotions, 3D computer vision, and energy-efficient architectures for embedded vision systems. The application areas to be considered include human-computer interaction, biometrics, affective computing, mixed reality, and biomedical image analysis. CMV has an extensive international collaboration network in Europe, the USA, and China.

Circuits and Systems (CAS)

The interest of the CAS group (Circuits and Systems) is devoted to certain novel devices, circuit topologies and functional units, although the group is also working with applications, especially in the field of electronic/optoelectronic measurements and radio telecommunications. The main research fields of the CAS group are high speed pulse electronics and linearization of electronics. In high speed pulse electronics, the research focus is on pulsed time-flight techniques and the development of related circuits, devices and applications. The group represents, for example, the current state of the art in the field of long-range of time-to-digital converter circuits. The specialty of this group is that in addition to electronics, it has also solid experience in optoelectronic circuits and devices. Within the topic of linearization of electronics the emphasis is on analysis and correction of non-linear distortion. In this field, the group has carried out fundamental work in explaining distortion memory effects in RF power amplifiers.

Communications Signal Processing (CSP)

The Communications Signal Processing (CSP) Research Group (RG) focuses on technologies required for efficient implementation of a multitude of devices or network nodes of the future connected society. The focal area of the research is to develop algorithms and their realizations for dense wireless networks, in particular for relatively small communication ranges in indoor and urban areas. This enables new massive multi-antenna access points or base stations, as well as user cooperation to realize the vision of virtual multiple-input multiple-output (MIMO) communications in both peer-to-peer and cellular networks. The system level algorithms are considered both for high rate access connections and their down-scaled versions for low-power and low-complexity wireless sensor network (WSN) applications, with a significant emphasis on medical applications.

Electronics Materials, Packaging and Reliability Techniques (EMPART)

The group consists of specialists in micro/nanoelectronics, materials, process, mechanical and electrical engineering. The research group brings together all the essential know-how to accomplish embedded multifunctional electronics integrations. These are based on new, difficult to copy hyper-active materials, high dielectric and optical performance materials, the most feasible, cost-aware fabrication technologies for hybrid electronics, and high-end state-of-the-art electronics integrations enabling functional diversification in line with, for example, the "More-than-Moore" concept for future electronics.

Networking (NET)

NET consists of three research groups: 1) Networking 2) Future Wireless Internet and Sensor Network Architectures and 3) Sensor Networking. In the search for future new networking paradigms, NET is doing research in the field of 5G/6G network architectures, wireless internet, cognitive networks, spectra management, networks economics and security, low exposure wireless networks, as well as future Internet applications. Scientific problems the group is engaged in include: network optimization on layers 2.5 (MAC) , 3 and 4, development of secure network architectures, development of efficient sensor networks architectures, and efficient protocols on the application layer. Mathematical tools used in the research are network optimization theory, network information theory, queuing and game theory. The NET group also runs an extensive doctoral program to educate our students in the field of networking.

New Generation Optoelectronics for Measurement Applications (NeGOMA)

The NeGOMA group focuses on development of solution processable components and systems (sensors and sensor networks, light sources, light detectors, optical components etc) for different kinds of measurement applications. Printing technology is one very promising fabrication concept for solution processable optoelectronics, but also some other methods are possibly used (evaporation, spin coating, dispensing etc.) to find the most feasible fabrication methods. The motivation is to find new ways of applying new generation optoelectronics to generate high level scientific knowledge, but also to find solutions which have real commercial potential in industry and health care.

Radio Access Technologies (RAT)

The Radio Access Technologies group is strongly focusing on 5G mobile cellular systems research. The key drivers in the research are densification of cells, improving transmission efficiency under interference, more efficient use of the existing spectrum in a multi-operator environment, radio access for future spectrum allocations, as well as radio channel modeling for beyond 6 GHz frequencies. The target is to develop fundamental theoretical tools for analysis and synthesis of future mobile systems, as well as development of selected key technology components needed in 5G systems.