### Workshop/Tutorial title:
5th Intl. Symposium on Automated Sensor Based Mobility Analysis for Disease Prevention and Treatment

### Organizers
- Brian Caulfield, University College Dublin
- Björn Eskofier, Friedrich-Alexander University Erlangen-Nürnberg (FAU)
- Barry R. Greene, Kinesis Health Technologies
- Jochen Klucken, University Hospital Erlangen

### Short description
Mobility defines the quality of life in health and disease. Sensor based information on gait and mobility is increasingly introduced into healthy living and disease monitoring. It supports primary prevention, diagnostic work-up and therapeutic decisions in a variety of disorders. In an ageing society, impairment of motor function is of increasing medical and economical relevance. In particular neurological, musculoskeletal and cardiovascular disorders reduce the ability to move independently and limit the autonomy of patients. Even though the disease causing mechanisms are specific for each disorder, mobility in general is limited. This makes mobility an important surrogate marker for disease severity and progress, but more importantly for therapeutic decisions and quality of life.

### Contents
Currently, modern body sensor network based motion detection systems are developed that (I) assess motor function in primary prevention and throughout the course of numerous movement disorder diseases, (II) provide objective measurement for therapeutic efficacy in clinical studies, and (III) support therapeutic decisions. The symposium will focus on the current knowledge and applications of body sensor network based motion detection systems in the clinic. It will bring together technical experts and physicians specialized in movement disorders to discuss the recent advances in the field of automated mobility analysis.

**Brian Caulfield** is a Professor of Physiotherapy in University College Dublin, where he also serves as a Director of the Insight Centre for Data Analytics. His research in Insight is focused on leveraging data from wearable sensors to better understand and enhance human performance in different health and sports applications.

**Björn Eskofier** is professor for 'Digital Support Systems in Sports and Health' within the Heisenberg-program of the German Research Foundation (DFG). He heads the Machine Learning and Data Analytics Lab of the FAU. Currently, this lab has 25 co-workers, working in the fields of machine learning and signal analysis for wearable computing systems with a focus on sports and health care.

**Barry R. Greene** is CTO and co-founder of Kinesis Health Technologies. He is responsible for technical direction, research and development and regulatory affairs. He has significant expertise in healthcare technology, in particular the application of biomedical signal processing, machine learning and statistics.

**Jochen Klucken** is a neurologist and movement disorder specialist at the University Hospital Erlangen, Germany. As a clinician he has been developing healthcare technologies for movement disorders since 10 years and is currently translating them into digital health applications.

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https://bhi-bsn.embs.org/2018/
5th Intl. Symposium on Automated Sensor Based Mobility Analysis for Disease Prevention and Treatment
At the 15th Annual International Body Sensor Networks Conference 2018
Date: March 4, 1330-1700 (afternoon session)
Venue: Room E, Treasure Island Hotel, Las Vegas, NV, USA
Organizers: B Caulfield, PhD; B Eskofier, PhD; B Greene, PhD; J Klucken, MD
(contact: bjoern.eskofier@fau.de)

Abstract:
Mobility defines the quality of life in health and disease. Sensor based information on gait and mobility is increasingly introduced into healthy living and disease monitoring. It supports primary prevention, diagnostic work-up and therapeutic decisions in a variety of disorders. In an ageing society, impairment of motor function is of increasing medical and economical relevance. In particular neurological, musculoskeletal and cardiovascular disorders reduce the ability to move independently and limit the autonomy of patients. Even though the disease-causing mechanisms are specific for each disorder, mobility in general is limited. This fact makes mobility an important surrogate marker for disease severity and progress, but more importantly for therapeutic decisions and quality of life.
Currently, modern body sensor network based motion detection systems are developed that (I) assess motor function in primary prevention and throughout the course of numerous movement disorder diseases, (II) provide objective measurement for therapeutic efficacy in clinical studies, and (III) support therapeutic decisions.
The symposium will focus on the current knowledge and applications of body sensor network based motion detection systems in the clinic. It will bring together technical experts and physicians specialized in movement disorders to discuss the recent advances in the field of automated mobility analysis. The half-day symposium will provide a forum for academia, clinicians, industry, health insurance, and governing bodies to exchange ideas and to promote collaboration.
This symposium was held for the first time in 2013 during Body Sensor Networks Conference in Boston, USA. The following editions took place in Zuerich, Switzerland, Boston, and San Francisco.

Speaker list:
Brian Caulfield, PhD, Insight Centre, University College Dublin, Ireland
Valeria De Luca, PhD, Novartis Institutes for Biomedical Research, Basel, Switzerland
Bjoern Eskofier, PhD, Machine Learning & Data Analytics Lab, FAU Erlangen-Nürnberg, Germany
Juan Haladjian, PhD, Chair for Applied Software Engineering, TU Munich, Germany
Jochen Klucken, MD, Dept. of Molecular Neurology, Universitätsklinikum Erlangen, Germany
David Kotz, PhD, Department of Computer Science, Dartmouth College, USA
Sunghoon Ivan Lee, PhD, Information & Computer Sciences, University of Massachusetts, Amherst, USA
Benny Lo, PhD, The Hamlyn Centre, Imperial College London, UK
Federico Parisi, PhD, Wireless Ad-hoc Sensor Networks Laboratory, Università di Parma, Italy
Jerker Westin, PhD, Dalarna University, Sweden
Wenyao Xu, PhD, Embedded Sensing and Computing Lab, University at Buffalo, USA
# Symposium program:

<table>
<thead>
<tr>
<th>Time</th>
<th>Title</th>
<th>Speaker(s)</th>
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<tbody>
<tr>
<td>13:30</td>
<td>Introduction and Overview of the Symposium</td>
<td>Bjoern Eskofier, PhD, Machine Learning and Data Analytics Lab, Erlangen, Germany&lt;br&gt;Brian Caulfield, PhD, Insight Centre, University College Dublin&lt;br&gt;Barry Greene, PhD, Kinesis Health Technology&lt;br&gt;Jochen Klucken, MD, Dept. of Molecular Neurology, Erlangen, Germany</td>
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<tr>
<td>13:40</td>
<td>A doctor’s view: from sensor-based solutions to digital health applications</td>
<td>Jochen Klucken, MD, Dept. of Molecular Neurology, University Hospital Erlangen, Germany</td>
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<td>14:00</td>
<td>A Scalable and Adaptive Paradigm for Software-Defined Rehabilitation</td>
<td>Wenyao Xu, PhD; Jeanne Langan, PhD, Embedded Sensing and Computing Lab, University at Buffalo, the State University of New York (SUNY), USA</td>
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<td>14:20</td>
<td>mHealth Technology for the Clinical Management of Chronic Conditions</td>
<td>Federico Parisi, PhD; Paolo Bonato, PhD, Department of Physical Medicine and Rehabilitation, Harvard Medical School, Spaulding Rehabilitation Hospital; Wyss Institute for Biologically Inspired Engineering, Harvard University</td>
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<td>14:40</td>
<td>Wearable technology to support and assess rehabilitation after knee and hip surgeries</td>
<td>Juan Haladjian, PhD; Bernd Brügge, PhD, Chair for Applied Software Engineering, Technical University Munich, Germany</td>
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<td>15:00</td>
<td>Coffee Break</td>
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<td>15:20</td>
<td>Computational jewelry for mobile health</td>
<td>David Kotz, PhD, Department of Computer Science, Dartmouth College, USA</td>
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<td>15:40</td>
<td>Pervasive Sensing and Wearable Technologies for Health</td>
<td>Benny Lo, PhD, The Hamlyn Centre, Imperial College London, UK</td>
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<td>16:00</td>
<td>Digital technologies and novel endpoints to address clinical and medical needs</td>
<td>Valeria De Luca, PhD, Translational Medicine, Novartis Institutes for Biomedical Research, Basel, Switzerland</td>
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<td>16:20</td>
<td>The Use of Wearable Sensors and Systems in Rehabilitation Medicine</td>
<td>Sunghoon Ivan Lee, PhD, College of Information and Computer Sciences, University of Massachusetts, Amherst, USA</td>
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<td>16:40</td>
<td>Sensors for individualizing Parkinson treatment</td>
<td>Jerker Westin, PhD; Ilias Thomas, PhD, Dalarna University, Sweden</td>
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<td>17:00</td>
<td>Joint Discussion</td>
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<td>17:15</td>
<td>End of Symposium</td>
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