

Special Session Title:

Time-series modelling of physiology: Inference, Implementation, and Interpretability

Special Session Organizer Name & Affiliation:

Glen Wright Colopy – Cenduit

Special Session Speaker Name & Affiliation 1:

Jeroen Bergmann – University of Oxford

Special Session Speaker Name & Affiliation 2:

Miguel A. G. Belmonte – University of Manchester

Special Session Speaker Name & Affiliation 3:

David A. Clifton – University of Oxford

Theme:

- 01. Biomedical Signal Processing
- 02. Biomedical Imaging and Image Processing
- 03. Micro/ Nano-bioengineering; Cellular/ Tissue Engineering &
- 04. Computational Systems & Synthetic Biology; Multiscale modeling
- 05. Cardiovascular and Respiratory Systems Engineering
- 06. Neural and Rehabilitation Engineering
- 07. Biomedical Sensors and Wearable Systems
- 08. Biorobotics and Biomechanics
- 09. Therapeutic & Diagnostic Systems and Technologies
- 10. Biomedical & Health Informatics
- 11. Biomedical Engineering Education and Society

Special Session Synopsis— Max 2000 Characters

With the conference theme of “Enabling Innovative Technologies for Global Healthcare”, few topics are more relevant than time-series modeling of patient vital-signs, which aims to learn and codify the dynamics of quotidian and alarming physiology in a principled framework. Medical data is collected (almost exclusively) in a time-dependent manner, and the context of such data is time dependent as well. However, much clinical inference either ignores or circumvents the time-dependent nature of such data.

Time-series modeling has great promise to provide clinical insights that non-time-series methods are apt to miss. Considerable work is required in the construction, implementation, and interpretation of the models, particularly in high-noise and automated settings such as monitoring patient physiology. We propose a session in which experts in time-series medical inference can share their know-how, highlighting the key areas in which time-series modelling may (i) incorporate known physiological dynamics, (ii) provide value over non-time-dependent methods, (iii) be applied robustly or automated in clinical or homecare settings, or (iv) aid in clinical interpretation of quantitative methods.

As methods such as Gaussian processes and LSTM Neural Networks gain prominence within medical informatics literature, we aim to provide a useful interface between experts in medical machine learning and clinical practitioners at EMBC.

Our invited speakers are respected experts who span the range of key topics in time-series patient models. This session will be of strong interest to members of the EMBC community who are familiar, or looking to become familiar, with the cutting edge of clinical informatics.

Following our successful 2018 and 2019 session the IET Healthcare Technology network (<http://www.theiet.org/>) has offered to co-sponsor the session. The session organizer has contacted the conference organizers separately to this submission to set this up.

Speaker 1 Synopsis

David A. Clifton, University of Oxford
Confirmed EMBC Attendee

Biographical Sketch of Speaker:

Prof. Clifton is Professor of Clinical Machine Learning in the Department of Engineering Science of the University of Oxford. He is a Research Fellow of the Royal Academy of Engineering, Visiting Chair in AI for Healthcare at the University of Manchester, and a Fellow of Fudan University, China. Prof. Clifton founded the Computational and Health Informatics Lab at the Oxford Institute of Biomedical Engineering, which opened its second site, in Suzhou, China in 2017. His research focuses on the development of "big data" machine learning for tracking the health of complex systems. He has worked on Visensia, the world's first FDA-approved multivariate patient monitoring system, and the SEND system, which is now used to monitor 20,000 patients each month in the NHS. His research has been commercialised via university spin-out companies OBS Medical, Oxehealth, and Medyc, in addition to collaboration with multinational industrial bodies. In 2016, Prof. Clifton was awarded a Grand Challenge award from the UK Engineering and Physical Sciences Research Council, which is a personal award that provides long-term strategic support for nine "future leaders in healthcare". He is a founding Associate Editor of the IEEE Journal of Biomedical & Healthcare Informatics (JBHI).

Title of presentation:

Bayesian Nonparametrics for Principled and Personalised Patient Models

Speaker 2 Synopsis

Glen Wright Colopy, Cenduit LLC
Confirmed EMBC Attendee

Biographical Sketch of Speaker:

Dr. Glen Wright Colopy is a lead data scientist at Cenduit, LLC, a UK-US contract research organization specializing in clinical trial support and drug supply. He was recently a researcher at the University of Oxford, Institute of Biomedical Engineering, where he completed his doctorate, and he has continuing research collaborations via the Oxford NIL Group. GWC specializes in personalized time-series modelling of high- and low-acuity patients and deriving personalized, interpretable warning scores from these models. Recent publications include several Invited IEEE JBHI papers on personalized models of patient vital-sign time-series, each with associated patents. His recent work includes applications of time-series techniques to improve the reliability of wearables and to optimize ventilation protocols.

Title of presentation:

Patient-Specific Machine Learning in Support of Clinical Trials

Speaker 3 Synopsis

Jeroen Bergmann, University of Oxford
Confirmed EMBC Attendee

Biographical Sketch of Speaker:

Prof Jeroen Bergmann is an Associate Professor at the Department of Engineering Science and Senior Research Fellow in Engineering & Entrepreneurship at the University of Oxford, the Group Leader of the Natural Interactions Lab, a Lecturer at Christ Church College and Director of the Oxford Healthtech Labs. His research interest is in developing new preventative and assistive technologies that allows for more natural interactions. He has experience in developing laboratory prototypes and taking them through clinical validation to make a real-world impact. His work focuses on the development, design and application of novel healthcare technologies. Active projects consist of creating wearables sensors for physical activity monitoring in extreme conditions, researching new solutions for limb-deficient patients, virtual prototyping and design affordability. His research vision is to prevent more people from becoming patients by creating innovative solutions.

Title of presentation:

Unobtrusive on-field monitoring to improve health and welfare of athletes

Speaker 4 Synopsis

Joseph Russell, University of Oxford
Confirmed EMBC Attendee

Biographical Sketch of Speaker:

Joseph Russell has a MEng from the University of Oxford and is currently Reading for a DPhil in Engineering Science with a focus on artificial limb control at the Natural Interactions Lab. He previously worked at the Research and Development department at Blatchford, one of the world's leading rehabilitation providers. Blatchford is a multi-award winning manufacturer of some of the world's most advanced prosthetic technology, bespoke seating solutions and orthotic devices. He has expertise in Biomedical Engineering, Control Systems Engineering and Electronic Engineering.

Title of presentation:

Intent detection for artificial limbs based on probabilistic modelling

Speaker 5 Synopsis

Aaron Ceross, University of Oxford
Confirmed EMBC Attendee

Biographical Sketch of Speaker:

Aaron Ceross is a researcher at the Natural Interactions Lab. Aaron does research in Legal Informatics, Natural Language Processing, Automated Reasoning and Regulatory Data Science. He completed an undergraduate degree in law at the University of Malta, Graduate Diploma in Law at Holborn College and worked in prominent barristers chambers. He also has an MSc in Computer Science from the University of Bristol and worked as a DPhil student in Cyber Security, Department of Computer Science at Oxford. His background is multidisciplinary, combining both law and computer science. The multidisciplinary nature of his research has led to publications across disciplines including law, software engineering, computer science, and public health.

Title of presentation:

Predication of medical device class based on intent description

Speaker 6 Synopsis

Miguel A. G. Belmonte, University of Manchester
Confirmed EMBC Attendee

Biographical Sketch of Speaker:

Miguel Belmonte is a researcher at the Department of Electrical and Electronic Engineering. He is currently analyzing jointly with Alexander J. Casson the Biobank dataset for physical activity in the UK. The aims of the analysis evolve around implementing non-uniform downsampling and behavioural phenotyping on a large dataset that is unlabeled. Miguel completed an undergraduate degree and MSc in Economics, specializing in Econometrics and time-series analysis. His PhD in Statistics at Warwick modelled financial time-series via state-space models and simulation-based methods. His current research interests are on application of machine learning and signal processing algorithms to extract information from accelerometer readings.

Title of presentation:

Stylized features of bio-signals. Modelling alternatives and feasibility considerations.