Programme

Sensor Signal Processing for Defence SSPD 2022

13th - 14th September London

IET London: Savoy Place



This conference is organised by the University Defence Research Collaboration (UDRC) in Signal Processing and it is sponsored by the Defence Science and Technology Laboratory (Dstl) and the Engineering and Physical Sciences Research Council (EPSRC). Dear Colleagues,

We warmly welcome you to this year's SSPD Conference, our second hybrid conference. This event is the 11th conference of the Sensor Signal Processing for Defence series and provides a chance to present, listen to and discuss the latest scientific findings in signal processing for defence.

We are privileged to have our two keynote speakers, Frédéric Barbaresco from Thales Land & Air Systems, France and Lieutenant General Tom R Copinger-Symes CBE, Deputy Commander UK Strategic Command. The SSPD 2022 conference also welcomes our invited speakers; Lance M. Kaplan, ARL, Simon Godsill, University of Cambridge and Jon Spencer, Dstl.

A welcome also extends to our panel speakers from Defence, Industry and Academia and the presenters of scientific papers presenting their novel research through live oral presentations. We look forward to some interesting debate and discussion throughout the conference.

We would like to take this opportunity to thank the speakers, reviewers, session chairs and the technical committee for their contribution to this event.

We hope you enjoy our conference.

Mike Davies Steve McLaughlin Jordi Barr Gary Heald









8:30 to 9:00 Refreshments

Session 1 – Applications and Implementation – Chair – Mike Davies, University of Edinburgh

9:00 Introduction and Welcome to Day 1/Session 1 - Mike Davies, University of Edinburgh.

9:10 – 10:10 Defence Keynote Speaker: Information Challenges in Multi-Domain Integration, Lt Gen Tom Copinger-Symes CBE, UK Strategic Command.

10:10 – 10:40 Invited Speaker: Dealing with Epistemic Uncertainty in Information Fusion Systems, Lance Kaplan, ARL.

10:40 – 11:05 Automatic Approximation for 1-Dimensional Feedback-Loop Computations: a PID Benchmark, Yun Wu¹, Yun Zhang¹, Anis Hamadouche¹, Joao Mota¹, Andrew M Wallace¹, ¹Heriot-Watt University.

11:05 - 11:35 Refreshments

11:35 – 12:00 Efficient Joint Surface Detection and Depth Estimation of Single-photon Lidar Data using assumed Density Filtering, Kristofer Drummond¹, Dan Yao¹, Agata Pawlikowska², Robert Lamb², Steve McLaughlin¹, Yoann Altmann¹, ¹Heriot-Watt University, ²Leonardo.

Session 2 - Panel Discussion and Lightning Posters - Chair - Jordi Barr - Dstl

12:00 Introduction and Welcome to Session 2 - Jordi Barr, Dstl

12:00 - 13:00 Panel Discussion: Open Source intelligence

13:00 - 13:30 Lightning Poster Presentations

P1. An Extension to the Frenet-Serret and Bishop Invariant Extended Kalman Filters for Tracking Accelerating Targets, Joe Gibbs¹, David Anderson¹, Matt MacDonald², John Russell², ¹University of Glasgow, ²Leonardo.

P2. Joint Undervolting and Overclocking Power Scaling Approximation on FPGA, Yun Wu¹, Joao Mota¹, Andrew M Wallace¹, ¹Heriot-Watt University.

P3. State Estimation of the Spread of COVID-19 in Saudi Arabia using Extended Kalman Filter, Lamia Alyami¹, Saptarshi Das¹, ¹University of Exeter.

P4. Optimal Bernoulli Point Estimation with Applications, Alexey Narykov¹, Murat Uney¹, Jason F. Ralph¹, ¹University of Liverpool.

P5. High Resolution DOA Estimation for Contiguous Target with Large Power Difference, Murtiza Ali¹, Karan Nathwani¹, ¹Indian Institute of Technology .

P6. Compressive Self-Noise Cancellation in Under water Acoustics, Pawan Kumar¹, Karan Nathwani¹, Vinayak Abrol², Suresh Kumar³, ¹Indian Institute of Technology,

²University of Oxford, ³DRDO, India.

P7. Non-Coherent Discrete Chirp Fourier Transform for Modulated LFM Parameter Estimation, Kaiyu Zhang¹, Fraser K Coutts¹, John Thompson¹, ¹University of Edinburgh.

P8. Unsupervised Expectation Propagation Method for Large-Scale Sparse Linear Inverse Problems, Dan Yao¹, Steve McLaughlin¹, Yoann Altmann¹, ¹Heriot-Watt University.

P9. Movement Classification and Segmentation Using Event-Based Sensing and Spiking Neural Networks, Paul Kirkland¹, Gaetano Di Caterina¹, ¹University of Strathclyde.

P10. Enhanced Space-Time Covariance Estimation Based on a System Identification Approach, Faizan Khattak; Ian Proudler¹, Stephan Weiss¹, ¹University of Strathclyde.

13:30 - 14:45 Lunch and Poster Presentations - There will be an opportunity to view posters either online or at Savoy Place (Q & A will use https://www.sli.do)

Session 3 Networking and Communications – Chair – Steve McLaughlin, Heriot-Watt University

14:45 Introduction and Welcome to Session 3 - Steve McLaughlin, Heriot-Watt University

14:45 OMASGAN: Out-of-distribution Minimum Anomaly Score GAN for Anomaly Detection, Nikolaos Dionelis¹, Sotirios Tsaftaris¹, Mehrdad Yaghoobi¹, ¹University of Edinburgh.

15:10 Refreshments

15:45 Fast Trajectory Forecasting With Automatic Identification System Broadcasts, Yicheng Wang¹, Murat Uney¹, ¹University of Liverpool.

16:10 Deep Learning for Spectral Filling in Radio Frequency Applications, Michael Girard¹, Matthew Setzler¹, Elizabeth Coda¹, Jeremiah Rounds¹, Michael Vann¹, ¹Pacific Northwest National Laboratory.

16:35 Closing remarks

19:30 Conference Reception Drinks - IET Savoy Place

20:00 Conference Dinner

8:30 to 9:00 Refreshments

Session 4 Machine Learning - Chair - James Hopgood, University of Edinburgh

9:00 Introduction and Welcome to Day 2/Session 4 – Machine Learning – James Hopgood, University of Edinburgh

9:05 – 10:05 Academic Keynote Speaker: Lie Groups Statistics and Machine Learning for Military Sensors based on Symplectic Structures of Information Geometry, Frédéric Barbaresco, Thales

10:05-10:35 Invited Speaker: Signal Processing for Military Communications, Jon Spencer, Dstl.

10:35 – 11:00 Robust DOA Estimation Based on Deep Neural Networks in Presence of Array Phase Errors, Xuyu Gao², Aifei Liu², Yutao Xiong², ¹Harbin Engineering University, ²Northwestern Polytechnical University.

11:00 - 11:25 Refreshments

Session 5 - Panel Discussion - Chair - Jordi Barr - Dstl

11:25 Introduction and Welcome to Session 5 - Jordi Barr, Dstl

11:25 – 12:25 Panel Discussion: Should defence be more university friendly or should universities be more defence friendly?

12:25 - 13:25 Lunch

Session 6 - Radar Sonar and Acoustics - Chair - Gary Heald, Dstl

13:25 Introduction and Welcome to Session 6 - Gary Heald, Dstl

13:25–13:55 Invited Speaker: Points, Particles and Positions: Recent Advances in Distributed Processing of Agile Objects, Simon Godsill, University of Cambridge.

13:55 – 14:20 A Polynomial Subspace Projection Approach for the Detection of Weak Voice Activity, Vincent W Neo¹, Stephan Weiss², Patrick A Naylor¹, ¹Imperial College London, ²University of Strathclyde.

14:20 – 14:45 Optimizing Sonobuoy Placement using Multiobjective Machine Learning, Christopher M Taylor¹, Simon Maskell¹, Jason F. Ralph¹, ¹University of Liverpool.

14:45 - 15:10 Refreshments

15:10 – 15:35 Image Quality SAR Refocus of Moving Targets undergoing Complicated Rolling Maneuvers, David A. Garren¹, ¹Naval Postgraduate School.

15:35 – 16:00 Learning Low-Rank Models From Compressive Measurements for Efficient Projection Design, Fraser K Coutts¹, John Thompson¹, Bernard Mulgrew¹, ¹University of Edinburgh.

16:00 – 16:25 LoRaWAN Performance Evaluation and Resilience under Jamming Attacks, Vaia Kalokidou¹, Manish Nair¹, Mark Beach¹, ¹University of Bristol.

16:25 Closing remarks

General Chairs

Mike Davies - University of Edinburgh Stephen McLaughlin - Heriot-Watt University Jordi Barr - Dstl Gary Heald - Dstl

Publicity and Local Arrangements Chair

Janet Forbes - University of Edinburgh

Technical Programme Committee

Abderrahim Halimi - Heriot-Watt University Alasdair Hunter - Dstl Andreas Ahrens - Hochschule Wismar Andrew Wallace - Heriot-Watt University Andy Stove - Stove Specialties Athanasios Gkelias - Imperial College London Augusto Aubry - Universita degli studi di Napoli Bernard Mulgrew - University of Edinburgh Brian Barber - Dstl Bruno Clerckx - Imperial College London Carmine Clemente - University of Strathclyde Chris Baker - University of Birmingham Christoph Wasserzier - Fraunhofer Institute for High Frequency Physics and Radar **Techniques FHR** Christos Ilioudis - University of Strathclyde Cristian Rusu - University of Edinburgh Dave Harvey - Thales David Blacknell - Dstl David Cormack - Leonardo David Garren - Naval Postgraduate School David Greig - Leonardo Domenico Gaglione - Centre for Maritime Research and Experimentation (CMRE) Duncan Williams - Dstl Emma Goldstein - Dstl Geert Leus - Delft University of Technology Harvev Alison - Leonardo Henry Gouk - University of Edinburgh Ian Proudler - University of Strathclyde Ivo Bukovsky - Czech Technical University in Prague James Hopgood - University of Edinburgh Iason Ralph - University of Liverpool Joao Mota - Heriot-Watt University

SSPD 2022 Technical Committee

John Thompson - University of Edinburgh Iulian Deeks - Dstl Ken McEwan - Dstl Krishnaprasad Nambur Ramamohan - Delft University of Technology Lyudmila Mihaylova - University of Sheffield Mahesh Banavar - Clarkson University Maria Greco - University of Pisa Mark Hadley - Kaon Limited Mathini Sellathurai - Heriot-Watt University Mehrdad Yaghoobi - University of Edinburgh Murat Unev - University of Liverpool Neil Cade - Leonardo Nikolaos Dionelis - University of Edinburgh Oliver Sims - Leonardo Paul Thomas - Dstl Richard Jackson - Dstl Sami Aldalahmeh - Al-Zaytoonah University of Jordan Sen Wang - Heriot-Watt University Simon Godsill - University of Cambridge Simon Maskell - University of Liverpool Stephan Weiss - University of Strathclyde Stephen Ablett - Dstl Suresh Jacob - Dstl Vladimir Stankovic - University of Strathclyde Wenwu Wang - University of Surrey Wolfgang Koch - Fraunhofer FKIE Yoann Altmann - Heriot-Watt University

Keynote Speakers

Frédéric Barbaresco

Senior THALES Expert in Artificial Intelligence at the Technical Department of THALES Land & Air Systems. SMART SENSORS Segment Leader for the THALES Corporate Technical Department (Key Technology Domain "Processing, Control & Cognition"). THALES representative at the AI Expert Group of ASD (AeroSpace and Defense Industries Association of Europe). 2014 Aymée Poirson Prize of the French Academy of Science for the application of science to industry. Ampère Medal, Emeritus Member of the SEE, and President of the SEE ISIC club "Information and Communication Systems Engineering". He is French MC representative of European COST CaLISTA (Cartan geometry, Lie, Integrable Systems, quantum group Theories for Applications) (https://www.cost.eu/actions/



CA21109/). General Chair of the following events: the "Geometric Science of Information" international conferences (https://franknielsen.github.io/GSI/), MaxEnt'22 conference at Institut Henri Poincaré (https://maxent22.see.asso.fr/), Ecole de Physique des Houches SPIGL'20 in July 2020 on « Joint Structures and Common Foundations of Statistical Physics, Information Geometry and Inference for Learning » (https://franknielsen.github.io/SPIG-LesHouches2020/) and FGSI'19 Conference "Foundations of Geometric Structures of Information" in February 2019 at IMAG "Institut Montpellierain Alexander Grothendieck" (https://fgsi2019.sciencesconf.org/). CIRM Luminy Seminar organizer of TGSI'17 "Topological and Geometrical Structures of Information" (http://forum.cs-dc.org/topic/361/tgsi2017-presentation-organisation-abstract-submission). Guest Editors of Special Issues "Lie Group Machine Learning and Lie Group Structure Preserving Integrators". Author of more than 200 scientific publications and more than 20 patents.

Abstract: Lie Groups Statistics and Machine Learning for Military Sensors based on Symplectic Structures of Information Geometry

In a first part, we will present pioneering THALES Sensors/Radars algorithms: Geometric Matrix CFAR based on Jean-Louis Koszul's Information Geometry and its extension for STAP, Complex-Valued Convolutional Neural Networks and Covariance-Matrix-Valued HPDNet for Micro-Doppler ATDR, Lie Group-based Convolutional Equivariant Neural Network from Geometric Deep Learning for Doppler clutter map, IEKF (Invariant Extended Kalman Filter) Frenet-Serret Tracker based on Lie Groups for hyper-maneuvering targets, Tracker parameters tuning by Deep Learning and finally, Multi-Agent Reinforcement Learning for Radar Task Scheduling and Active-Track/TWS collaborative Resources Management. In a second part, we will present Avant-Garde tools using statistics on Lie Groups for different sensors applications (detection, tracking and recognition). From French Jean-Marie Souriau's Symplectic Model of Statistical Physics and Russian Kirillov's Representation Theory of Lie Groups, we will introduce Gaussian statistical density for Lie Groups defined as Maximum Entropy Gibbs density on coadjoint orbits though moment map. This Symplectic model of Information gives new geometric foundation for Entropy, defined purely geometrically (and no longer axiomatically) as Casimir Invariant Function in Coadjoint Representation. We will conclude with new perspectives opened by this new Symplectic Theory of Heat and Information.

Keynote Speakers

Lieutenant General T R Copinger-Symes

Tom spent his early career with The Rifles on operations in Northern Ireland, Bosnia, Kosovo, Iraq and Afghanistan, and in operational and strategy posts at the Permanent Joint Headquarters and the Ministry of Defence.

For the past 10 years he has focused on how the Army and Defence can make better use of its data and information, whether in supporting traditional warfighting or employed as a weapon in its own right - especially in the context of 'sub-threshold' competition. This has included command at brigade (1 ISR Bde) and divisional levels (Force Troops Command - now 6th (UK)



Div), as well as, in his last post as Director of Military Digitisation, leading Defence's Digital Transformation portfolio.

In May 2022 Tom was promoted to Lieutenant General, on appointment as the Deputy Commander of UK Strategic Command.

Title: Information Challenges in Multi-Domain Integration

Invited Speakers

Lance M. Kaplan, ARL

Lance M. Kaplan received his undergraduate degree at Duke University in 1989 and a PhD degree from the University of Southern California in 1994, all in Electrical Engineering. He held a National Science Foundation Graduate Fellowship and a USC Dean's Merit Fellowship from 1990–1993. Dr. Kaplan previously worked at the Georgia Tech Research Institute (1987-1990) and the Hughes Aircraft Company (1994-1996). He was a faculty member in the Department of Engineering at Clark Atlanta University from 1996-2004. Currently, he is a team leader in the Context Aware Processing branch of the DEVCOM Army Research



Laboratory (ARL). Dr. Kaplan serves as VP Publications for the IEEE Aerospace and Electronic Systems (AES) Society (2021-Present) and as VP Conferences for the International Society of Information Fusion (ISIF) (2014-Present). Previously, he served as Editor-In-Chief for the IEEE Transactions on AES (2012-2017), on the Board of Governors for the IEEE AES Society (2008-2013, 2018-2020) and on the Board of Directors of ISIF (2012-2014). He is a Fellow of IEEE and of ARL. His current research interests include information/data fusion, reasoning under uncertainty, network science, resource management and signal and image processing.

Abstract: Dealing with Epistemic Uncertainty in Information Fusion Systems

Information fusion is basically the weighted averaging of data from different sources where the weights are inversely proportional to the uncertainty for the data sources. Generally, the uncertainty is aggregated from likelihood models to characterize the probability of the unknown states in light of the observations. In many fusion systems, the likelihood functions are presumed to be known, but in practice they must be machine learned via a calibration process. In Army applications, there can be little training data to accurately learn these likelihoods. This talk will address the epistemic uncertainty as a second-order uncertainty about the likelihoods in cases where very little training exists. Specifically, the talk will highlight new methods to compute error bars around probabilistic outputs of Bayesian and neural networks. Furthermore, it enables new paradigms for establishing prediction sets of feasible hypotheses rather than the most likely hypothesis, which can be very misleading in cases of imbalance of epistemic uncertainty.

Invited Speakers

Professor Simon Godsill, University of Cambridge

Simon Godsill is Professor of Statistical Signal Processing in the Engineering Department at Cambridge University. He is also a Professorial Fellow and tutor at Corpus Christi College Cambridge. He coordinates an active research group in Signal Inference and its Applications within the Signal Processing and Communications Laboratory at Cambridge, specializing in Bayesian computational methodology, multiple object tracking, audio and music processing, and financial time series modeling. A particular methodological theme over recent years has been the development of novel techniques for optimal Bayesian



filtering and smoothing, using Sequential Monte Carlo or Particle Filtering methods. Prof. Godsill has published extensively in journals, books and international conference proceedings, and has given a number of high profile invited and plenary addresses at conferences such as the Valencia conference on Bayesian Statistics, the IEEE Statistical Signal Processing Workshop and the Conference on Bayesian Inference for Stochasrtic Processes (BISP). He co-authored a seminal Springer text Digital Audio Restoration with Prof. Peter Rayner in 1998. He was technical chair of the successful IEEE NSSPW workshop in 2006 on sequential and nonlinear filtering methods, and has been on the conference panel for numerous other conferences/workshops. Prof. Godsill has served as Associate Editor for IEEE Tr. Signal Processing and the journal Bayesian Analysis. He was Theme Leader in Tracking and Reasoning over Time for the UK's Data and Information Fusion Defence Technology Centre (DIF-DTC) and Principal Investigator on many grants funded by the EU, EPSRC, QinetiQ, General Dynamics, MOD, Microsoft UK, Citibank and Mastercard. In 2009-10 he was co-organiser of an 18 month research program in Sequential Monte Carlo Methods at the SAMSI Institute in North Carolina. He is a Director of CEDAR Audio Ltd. (which has received numerous accolades over the years, including a technical Oscar).

Abstract: Points, particles and positions: recent advances in distributed processing of agile objects

In this talk I will discuss models developed under the SIGNeTS project for agile motion of objects. I will describe new motion and observation models based on point process theory and Levy processes, as well as new advances in Gaussian process models for nonparametric modelling of motion, and will further discuss methods for distributed processing of sensor data using these models, as well as inference about target detection rates and clutter rates. The methodology is probabilistic and implemented using combinations of particle filtering and variational methods.

Invited Speakers

Jon Spencer CPhys FInstP, Dstl

Jon is the Chief Communications and Networks Scientist at the Defence Science and Technology Laboratory (Dstl), part of the UK Ministry of Defence. Jon leads the delivery of communications research spanning all military domains from subsea to space, focusing on develop ment of next-generation and generation-afternext resilient systems to enable information driven operations in the most challenging environments.

As lead scientist for the Communications and Networks programme Jon coordinates research to develop and demonstrate the advanced concepts that will enable Information Advantage in the contested



environments of the future. Working with allies and partners from UK industry and academia we are investing in research both to bring forward the military capabilities essential for future operations and to stimulate the development of skills and facilities in the supply chain.

The work is wide ranging. It stretches from fundamental physical research into the propagation environment; maturing novel communications concepts such as Quantum communications; developing new ideas for networking in very congested and dynamic environments through to developing the architectures needed to enable rapid integration and adaptation.

Jon has been active in the development of tactical communications and networking capabilities for 25 years, both in government research and in industry where he led a number of successful product developments. Jon is a Fellow of the Institute of Physics.

Abstract: Multi-Spectral and Multi-Modal Underwater Acoustic Imaging

Communications and Networks are fundamental enablers to military capability. This talk will explain some of the fundamental threats and technical challenges faced when delivering communications and networks capability for military operations. UK Ministry of Defence has recently announced a significant investment in communications and networks research to address these challenges and an overview of that programme will be presented along with opportunities to contribute. Access to appropriate signal processing techniques is essential to this and the talk will discuss some of the signal processing challenges to enable covert and overt communications.

Delegate List

Abderrahim Halimi Aifei Liu Alain Chance Alasdair Hunter Alex Vicente Sola Alexander Lindmaa Alexev Narvkov Alistair Keffen Andrew Wallace Angus Mackenzie Anis Hamadouche Becky Cowan Ben Hopson Bernard Mulgrew Boni Hima Brian Barber Charles Offer Chloe Holstead Christopher Taylor Connor Delasosa Dan Yao David Cormack David Garren David Vint Davide Manna Debra Lallv Duncan Williams Elizabeth Coda Faizan Khattak Fraser Coutts Frédéric Barbaresco Garv Heald Gavin Pearson Graeme Docherty - Walthew Hannah Durnall Harvey Alison Hugh Griffiths Ian Proudler Isobel Webster **James Reason** James Wright James Hopgood

Heriot-Watt University Northwestern Polytechnical University **Ouantalain** Dstl University of Strathclyde Saab Group University of Liverpool Atlas Elektronik Heriot-Watt University Atlas Elektronik Heriot-Watt University John Wiley & Sons, Ltd Leonardo University of Edinburgh Dstl Dstl Thales Dstl University of Liverpool Leonardo Heriot-Watt University Leonardo Naval Postgraduate School University of Strathclyde University of Strathclyde Dstl Dstl Pacific Northwest National Laboratory University of Strathclyde University of Edinburgh Thales Dstl Dstl Leonardo Leonardo Leonardo UCL University of Strathclyde Leonardo **MBDA Systems** Dstl University of Edinburgh

Delegate List

Janet Forbes Ioe Gibbs John Thompson Ion Spencer Iordi Barr **Julian Deeks** Kaiyu Zhang Karan Nathwani Kate Hocking Kristofer Drummond Lamia Alvami Lance Kaplan Lauren Jeeves Lt Gen Tom Copinger-Symes CBE Luke Walker Mark Beach Martin Ottenklev Mathini Sellathurai Mengwei Sun Michael Hughes Mike Davies Murat Uney Natalie Flaherty Nikolaos Dionelis Oskar Lindblad Paul Brown Paul Thomas Paul Kirkland Prabin Pradhan Rebecca Lane Ros Knowles Russell McKinlay Samuel Drake Samuel Waterfall Sarah Liaw Sebastian Durst Shaula Garibbo Simon Potter Simon Godsill Stephan Weiss Stephen Ablett Steve McLaughlin

University of Edinburgh University of Glasgow University of Edinburgh Dstl Dstl Dstl University of Edinburgh Indian Institute of Technology Leonardo Heriot-Watt University/Leonardo University of Exeter ARL Dstl **UK Strategic Command** Leonardo University of Bristol Saab Group Heriot-Watt University University of Edinburgh University of Liverpool University of Edinburgh University of Liverpool Heriot-Watt University University of Edinburgh Saab AB Atlas Elektronik Dstl University of Strathclyde Dstl Atlas Elektronik Dstl Dstl Flinders University Atlas Elektronik California Institute of Technology Fraunhofer University of Bath University of Cambridge University of Strathclyde

University of Strathclyde Dstl Heriot-Watt University

Delegate List

Steve White Steven Horstmann Taha Selim Thomas Bassett Thomas Eddleston Thomas Fraser Thomas Short Vincent Neo Vladimir Stankovic Wenwu Wang Yicheng Wang Yoann Altmann Yun Wu Zach Gazak Dstl Leonardo

MBDA Systems Dstl Heriot-Watt University Atlas Elektronik Imperial College London University of Strathclyde University of Surrey University of Liverpool Heriot-Watt University Heriot-Watt University USA Space Systems Command

SPD 2023

Sensor Signal Processing for Defence Conference



Important Dates:

Submission of Papers: 16th April 2023

Notification of Paper Acceptance: 30th June 2023 Final version of Paper Due: 30th July 2023

Date of conference: 12 to 13 September 2023

Online / Royal College of Physicians Edinburgh

International Conference in Sensor Signal Processing for Defence: from Sensor to Decision

Signal Processing for Defence Conference is organised by the University Defence Research Collaboration (UDRC) in Signal Processing. SSPD 2023 aims to bring together researchers from academia, industry and government organisations interested in Signal Processing for Defence.

Papers are solicited from the following areas:-

- Array Signal Processing

- Mage Processing Radar, Sonar and Acoustic Multimodal Signal Processing
- Multi-Target Tracking
- Signal Acquisition and Sensor Management
- Multiple-input and multiple-output (MIMO)
- -Deep Learning, Machine Learning

- Source Separation Anomaly Detection
- Distributed Signal Processing
- Low Size Weight & Power Solutions Target Detection and Identification
- Electro-Optic Sensing

All submitted papers will be peer reviewed. Technical sponsorship is provided by the IEEE Signal Processing Society and proceedings will be submitted to the Xplore Digital Library.











UDRC Summer School 26-29 June, 2023 University of Edinburgh

IMPORTANT DATES

Application Opens: 3 January 2023
Deadline for Application: 17 March 2023

Notification of Application: 31 March 2023

This four day school is for researchers in industry, defence and academia with an interest in Signal Processing for Defence and a knowledge of Mathematics/Statistics at Masters level.

Summer School Programme

Monday 26 June	Statistical Signal Processing
Tuesday 27 June	Sensing and Tracking
Wednesday 28 June	Machine Learning
Thursday 29 June	Source Separation and Beamforming

www.mod-udrc.org

This summer school is delivered under the University Defence Research Collaboration (UDRC) in Signal Processing in the Information Age and is funded by EPSRC and Dstl.







Engineering and Physical Sciences Research Council

www.sspdconference.org