

Dr. Murat ÜNEY,
Research Fellow

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Research Experience	<p>University of Edinburgh, School of Engineering Research Fellow June 2013 - Present Distributed signal and information processing for wide area surveillance applications</p> <p>Heriot-Watt University, School of Eng. & Physical Sciences Research Associate March 2010 - June 2013 Distributed data fusion for multi-sensor surveillance applications</p> <p>Sabancı University, Signal Processing and Information Systems Lab., İstanbul, Turkey Graduate Research Assistant Feb. 2007 - Feb. 2010 Distributed estimation for sensor network applications</p> <p>Middle East Technical University, Grad. School of Natural & Applied Sciences, Ankara, Turkey Graduate Research Assistant Sept. 1999 - Sept. 2002 Signal processing and telecommunications, digital signal processing (DSP) software</p>
Industrial Experience	<p>TÜBİTAK UEKAE İltaren Research Group, Ankara, Turkey Research and Development Engineer Jan. 2004 - Feb. 2007 Analysis, modelling and simulation of electro-optic sensors and sensor platforms</p>
Education	<p>Middle East Technical University, Ankara, Turkey Ph.d. in Electrical and Electronics Engineering (CGPA: 3.63/4.0) Sept. 2003 - Aug. 2009 M.Sc. in Electrical and Electronics Engineering (CGPA: 3.93/4.0) Sept. 1999 - Aug. 2001</p> <p>Ankara University, Ankara, Turkey B.Sc. in Electronics Engineering (CGPA: 86/100) Sept. 1995 - June 1999</p>
Research Interests	Statistical signal & information processing and data fusion; Probabilistic modelling and statistical inference ; Probabilistic graphical models; Distributed/collaborative processing and optimisation; Monte Carlo methods, point processes; Signal processing in active and passive sensors, target tracking, networked sensing
Key Research Outcomes & Impact	<ul style="list-style-type: none">• Development and theoretical analysis of distributed multi-sensor calibration algorithms for object tracking networks [1, 2, 9, 10, 12, 13] (UoE)• Ongoing planning for demonstration of these algorithms for sensor self-localisation in a commercial multi-sensor fusion system in collaboration with Cubica Technologies and DSTL (UoE)• Significant contribution to the UDRC programme mid-term review and research strategy (UoE)• Development of distributed multi-sensor fusion algorithms for multi-sensor target tracking applications [5, 16, 18] which attracted two follow up grants (HWU)• Significant contribution to the follow up proposals of £45K and £40K (HWU)• Demonstration of the developed algorithms on a maritime radar/camera multi-sensor suite with real-time data, in collaboration with BAE Systems Advanced Technology Centre (ATC) and DSTL (HWU)

- Developed distributed estimation/communication strategy optimisation algorithms using Monte Carlo methods and demonstrated graceful degradation of estimation accuracy with increasing communication cost in sensor networks [3, 6](SU/METU)

Supervision and Teaching

- First supervisor of one Ph.D. project on detection of low-probability-of-detect targets using multiple radars (UoE).
- Developed and delivered tutorials on **optimal and adaptive filtering** in UDRC Summer Schools 2016,15 to large numbers of people (> 50) from the industry and the academia (UoE).
- Demonstration and presentations in UDRC Summer School 2014,13 (UoE).
- Assisted in tutorials for undergraduate level probability theory and graduate level estimation theory classes for engineering students (HWU)
- Chairing UDRC research coordination meetings and the reading group (UoE)
- Organised bi-weekly research meetings and the journal club (SU)
- Supervision of one final year graduation project by two engineering students (SU)

Professional Activities

- Reviewer for journals IEEE Transactions on Signal Processing, IEEE Signal Processing Letters, IEEE Transactions on Signal and Information Processing in Networks, IEEE Systems, Man, and Cybernetics Part-B, IEEE Transactions on Aerospace and Electronic Systems, Elsevier DSP, Elsevier Information Fusion, IET Circuits Devices and Systems, IET Signal Processing, IEEE Transactions on Circuits and Systems for Video Technology and Turkish Journal of Electrical Eng. and Computer Sciences.
- Served in the technical programme committee (TPC) of International Conference on Information Fusion 2016, 2015, 2014 and 2013, Sensor Signal Processing for Defence (SSPD) 2016, 2015, 2014, 2011 and 2010, International Conference on Pattern Recognition (ICPR) 2010.
- Member, IEEE Signal Processing Society.

Participated Projects

UDRC 2 EWP2: Distributed multi-sensor processing (UoE)

June 2013 - Present

- Funded through the University Defence Research Collaboration (UDRC) Phase 2, sponsored by EPSRC and DSTL
- Identification and fulfillment of research goals and objectives for the project which involves one Phd project
- Publishing results in scholarly journals and conferences, first supervision of the PhD student
- Organisation of research and journal club meetings for UDRC researchers.
- Development and theoretical analysis of algorithms for i) distributed sensor calibration (e.g., self-localisation) in object tracking networks [1, 2, 9, 10, 12, 13], ii) detection of low SNR/manoeuvring objects [7, 8, 11], iii) Higher-order spatial statistics in fusion [4].

UDRC 1 O02: Distributed target tracking algorithms (HWU)

Apr. 2010 - Feb. 2012

- Research on solving multi-sensor fusion problems using *Random Finite Set* with Dr. Daniel Clark (line manager) and Dr. Simon Julier (University College London) [5, 16, 18]
- Funded through the UDRC Phase 1, attracted two follow-up projects: UDRC/DSTL O18 and CDE/DSTL IND1.
- Significant contribution to follow-up proposals (approx. £45K and £40K for HWU)

UDRC 1 O18: Multi-sensor registration for passive sensors (HWU) **March 2012 - July 2012**

- Demonstrated random finite set techniques for emitter geo-location with passive sensors [15]

CDE/DSTL IND1: Demonstration of Advanced Distributed Tracking Algorithms (HWU) **Aug. 2012 - April 2013**

- In collaboration with BAE Systems and UCL, demonstrated the algorithms developed in UDRC 1 O02 on real data, online [14].
- Funded by Centre for Defence Enterprise (CDE) through DSTL.
- Implementation of the proposed algorithms in TRL 5-6 (pre-commercialisation level).

EP/J015180/1: Sensor signal processing (HWU,UoE) **Aug. 2012 - Oct. 2013**

- This grant allowed us to fund our research activities during CDE/DSTL IND1

Thesis

PhD Thesis: “Decentralized Estimation Under Communication Constraints” addresses estimation with distributed sensor networks using Bayesian team decision theory and Monte Carlo methods

Advisor: Prof. Dr. Kemal LEBLEBİCİOĞLU, METU, EEE Dept.

Co-advisor: Assist. Prof. Dr. Müjdat ÇETİN , Sabancı University, FENS

M.Sc. Thesis: “Direct and Blind Deconvolution for Multi-Dimensional Signals” generalises a 1-D deconvolution technique to signals with multi-dimensional domains

Advisor: Assoc. Prof. Dr. Engin TUNCER

Signal processing related

- Passed Ph.d. Qualification exam for Signal Proc. as the major field (and pattern recognition as the special interest area) and control systems as the minor field.
- Taken graduate courses on signal processing and communications including statistical, adaptive, multi-resolution signal processing, wireless and digital communications, dynamical systems theory, optimization, information theory, machine vision and pattern recognition during M.Sc.&Ph.d. studies.
- Designed and implemented a ANSI C modem library for the V.22, V.26, V.26ter and V.32 recommendations of the International Telecommunications Union (ITU) on Texas Instruments TI-C54x fixed point Digital Signal Processor.
- For BICOM, INC. located at Monroe, CT, USA, implemented an International Telecommunication Union (ITU) Standard T1, T3 codec and a BICOM Fax Description Language interpreter in C/C++ that works in the fax API of the company.

Skills

Prolific in MATLAB and SIMULINK, a good command of ANSI C. Industrial experience in C++, modular programming and Object Oriented Programming, fixed point programming, Texas Instruments C54x Assembly, Windows and Linux platforms, Visual C++ and .NET IDE, bug tracking and version control tools.

References

Available upon request.

Complete List of Publications

Journal Publications

- [1] Murat Üney, Bernard Mulgrew, Daniel Clark, "Latent parameter estimation in fusion networks using separable likelihoods," *IEEE Transactions on Signal and Information Processing Over Networks*, under revision.
- [2] Murat Üney, Bernard Mulgrew, Daniel Clark, "A cooperative approach to sensor localisation in distributed fusion networks," *IEEE Transactions on Signal Processing*, March, vol. 63, no.5, pp. 1187–1199, March 2016.
- [3] Murat Üney and Müjdat Çetin, "Optimization of Decentralized Random Field Estimation Networks Under Communication Constraints through Monte Carlo Methods," *Elsevier Digital Signal Processing*, vol.36, pp. 16–28, November 2014.
- [4] Emmanuel Delande, Murat Üney, Jeremie Houssineau, Daniel Clark, "Regional variance for multi-object filtering," *IEEE Transactions on Signal Processing*, vol.62, no.13, pp.3415–3428, July 2014.
- [5] Murat Üney, Daniel E. Clark, Simon J. Julier, "Distributed Fusion of PHD Filters via Exponential Mixture Densities," *IEEE Journal of Selected Topics in Signal Processing*, vol. 7, no. 3, pp. 521–531, June 2013.
- [6] Murat Üney and Müjdat Çetin, "Monte Carlo optimization of decentralized estimation networks over Directed Acyclic Graphs under communication constraints," *IEEE Transactions on Signal Processing*, vol. 59, no. 11, pp. 5558-5576, November 2011.

Conference Publications and Technical Reports

- [7] Kimin Kim, Murat Üney, Bernard Mulgrew, "Simultaneous tracking and long time integration for detection in collaborative array radars," *IEEE Radar Conf. 2017*, submitted.
- [8] Kimin Kim, Murat Üney, Bernard Mulgrew, "Detection of manoeuvring low SNR objects in receiver arrays," *SSPD 2016*, Edinburgh, UK, September 2016.
- [9] Murat Üney, Bernard Mulgrew, Daniel Clark, "Distributed localisation of sensors with partially overlapping field-of-views in fusion networks," *Fusion 2016*, Heidelberg, Germany, July 2016.
- [10] Murat Üney, Bernard Mulgrew, Daniel Clark, "Distributed estimation of latent parameters in state space models using separable likelihoods," *ICASSP 2016*, Shanghai, China, March 2016.
- [11] Murat Üney, Bernard Mulgrew, Daniel Clark, "Maximum likelihood signal parameter estimation via track before detect," *SSPD 2015*, Sept. 2015.
- [12] Murat Üney, Bernard Mulgrew, Daniel Clark, "Target aided online sensor localisation for bearing only clusters," *SSPD 2014*, Edinburgh UK, Sep. 2014.
- [13] Murat Üney, Bernard Mulgrew, Daniel Clark, "Cooperative sensor localisation in distributed fusion networks by exploiting non-cooperative targets," *IEEE Workshop on Statistical Signal Processing 2014*, Gold Coast Australia, 2014.
- [14] J. Barr, Murat Üney, D. E. Clark, D. Miller, M. Porter, A. Gning and S. J. Julier, "A multi-sensor inference and data fusion method for tracking small, manoeuvrable maritime craft in cluttered regions," the Proc. of the 3rd IMA Conference on Mathematics in Defence. IMA, Malvern, UK, October 2013.

- [15] Murat Üney, Daniel E. Clark, Simon J. Julier, “Distributed sensor registration based on random finite set representations,” *Proc. of the SSPD 2012*. UDRC, London, UK, Sep. 2012.
- [16] Murat Üney, Daniel E. Clark, Simon J. Julier, “On the role of information measures in distributed multi-target tracking,” *Proc. of the Int. Conf. on Info. Fusion 2011*, July 2011.
- [17] Murat Üney and Müjdat Çetin, “Monte Carlo optimization approach for decentralized estimation networks under communication constraints,” *Sabancı University Technical Report*, SU FENS 2010/0007, <http://research.sabanciuniv.edu/15985>, Nov. 2010.
- [18] Murat Üney, Simon J. Julier, Daniel E. Clark, Branko Ristić, “Monte Carlo realisation of a distributed multi-object fusion algorithm,” in *the Proc. of the SSPD 2010*. UDRC, London, UK, Sep. 2010.
- [19] Murat Üney and Müjdat Çetin, “An Efficient Monte Carlo Approach for Optimizing Decentralized Estimation Networks Constrained by Undirected Topologies,” in *the Proc. of the Workshop on Statistical Signal Processing (SSP) 2009*. IEEE, Cardiff, Wales, UK, Aug. 2009.
- [20] Murat Üney and Müjdat Çetin, “An Efficient Monte Carlo Approach for Optimizing Communication Constrained Decentralized Estimation Networks,” in *the Proc. of the 17th EUSIPCO*. EURASIP, Glasgow, Scotland, UK, Aug. 2009.
- [21] Murat Üney and Müjdat Çetin, “İletişim Kısıtları Altında Dağıtık Rasgele-Alan Kestirimi (Decentralized Random-Field Estimation Under Communication Constraints),” in *the Proc. of the 17th Conference on Signal Processing, Communications, and their Applications (SIU 2009)*. IEEE, Antalya, Turkey, April 2009 (best runner-up for the IEEE student paper competition, in Turkish, available through IEEE Xplorer).
- [22] Murat Üney and Müjdat Çetin, “Akustik Algılayıcı Ağlarında Çarpan Çizgeleri Kullanarak Hedef Konumlandırma (Target Localization in Acoustic Sensor Networks Using Factor Graphs),” in *the Proc. of the 16th Conference on Signal Processing, Communications, and their Applications (SIU 2008)*. IEEE, Aydın, Turkey, April 2008 (in Turkish, available through IEEE Xplorer).
- [23] Murat Üney and Müjdat Çetin, “Graphical Model-based Approaches to Target Tracking in Sensor Networks: An Overview of Some Recent Work and Challenges,” in *the Proc. of the Int. Symp. on Image and Signal Proc. and Analysis (ISPA 2007)*. IEEE, İstanbul, Turkey, September 2007.

Dissertation and Thesis

- [24] Murat Üney, “Decentralized Estimation Under Communication Constraints,” *Ph.D. Thesis*, Middle East Technical University, Ankara, August 2009.
- [25] Murat Üney, “Direct and Blind Deconvolution for Multi-Dimensional Signals,” *M.Sc. Thesis*, Middle East Technical University, Ankara, August 2001.

National Conferences

- [26] Murat Üney and T. Engin Tuncer, “2-D Dizilerin Hatasız Ters-Evrişimi (Exact Deconvolution of 2-D Signals),” in *National Symposium on Signal Processing, Communications and Its Applications (SIU 2002)*, Denizli, Turkey, 2002 (in Turkish).

- [27] Murat Üney and T. Engin Tuncer, “Kanal Yankı Giderici için Ters Dönüşümlü Dizilerin Kullanımı (Utilization of Invertible Pseudonoise Sequences for Fast Echo Cancellation),” in *National Symposium on Signal Processing, Communications and Its Applications (SIU 2001)*, Gazi Magusa, 2001 (in Turkish).