January 3, 2017

Tutorial proposal for 20th International Conference on Information Fusion, July 10-13, 2017, Xi'an, China.

The title of the proposed tutorial:
"40 years of tracking for radar systems: a cross-disciplinary academic and industry point of view"
The intended audience:
 The communities of tracking and radar, sonar, location systems.
Prerequisites for the background knowledge of the attendees:
Basic probability theory, stochastic filtering, signal processing, radar systems,
A description of the tutorial, including the learning objectives, a short summary of the material to be presented and a brief topical outline:

Summary:
The talk will describe the intertwined R&D activities, along several decades, between academia and industry in conceiving and implementing - on live radar systems - tracking algorithms for targets in civilian as well as defence and security applications.
We trace back from the alpha-beta adaptive filter to modern random set filters passing thru Kalman algorithm (in its many embodiments), Multiple Model filters, Multiple Hypothesis Tracking, Joint Probabilistic Data Association, Particle filter for nonlinear non Gaussian models. Fusion from heterogeneous collocated as well as non-collocated sensor data are also mentioned. Applications to land, naval and airborne sensors are considered. Active as well as passive radar experiences are overviewed. The description will be a balanced look to both mathematical aspects as well as practical implementation issues including mitigation of real life system limitations.

List of contents:
Who we are (short introduction of the authors and their organizations),
Historical overview of the long-standing cooperation.
Retracing the evolution of the tracking algorithms (track initiation, data association filtering, adaptive features, track quality measure, plot-track fusion, track termination, sensor registration, grid locking, etc.).
More recent developments: Random Finite Sets in multi-target tracking and applications.
Setting up the performance evaluation tools (simulation, Posterior CRLB, recorded live data),
Impact of implementation on live systems: budget of errors, hardware/software limitations, environment limitations (clutter, multipath, ducting, atmosphere non linearity/anisotropy, etc.),
Mitigation techniques of above mentioned limitations,
Validation & test: lesson learned,
Conclusion and way ahead,
References,
Acknowledgements.
Course material required/supplied such as books, course notes and software:
Course notes will be provided as printed copies and pdf files of the presented slides
Biographical sketch of the instructor(s) including previous teaching experience:
Biographical sketch of Alfonso FARINA, FIEEE, FIET, FREng, Fellow of EURASIP, received the degree in Electronic Engineering from the University of Rome (IT) in 1973. In 1974, he joined Selenia, then Selex ES, where he became Director of the Analysis of Integrated Systems Unit and subsequently Director of Engineering of the Large Business Systems Division. In 2012, he was Senior VP and Chief Technology Officer of the company, reporting directly to the President. From 2013 to 2014, he was senior advisor to the CTO. He retired in October 2014. From 1979 to 1985, he was also professor of "Radar

Techniques" at the University of Naples (IT). He is the author of more than 600 peer-reviewed technical publications and of books and monographs (published worldwide), some of them also translated in to Russian and Chinese. Some of the most significant awards he's received include: (2004) Leader of the team that won the First Prize of the first edition of the Finmeccanica Award for Innovation Technology, out of more than 330 submitted projects by the Companies of Finmeccanica Group; (2005) International Fellow of the Royal Academy of Engineering, U.K., and the fellowship was presented to him by HRH Prince Philip, the Duke of Edinburgh; (2010) IEEE Dennis J. Picard Medal for Radar Technologies and Applications for "Continuous, Innovative, Theoretical, and Practical Contributions to Radar Systems and Adaptive Signal Processing Techniques"; (2012) Oscar Masi award for the AULOS® "green" radar by the Italian Industrial Research Association (AIRI); (2014) IET Achievement Medal for "Outstanding contributions to radar system design, signal, data and image processing, and data fusion". He is a Visiting Professor at UCL, Dept. of Electronics, CTIF (Center for TeleInFrastructures) Industry Advisory Chair. Alfonso was one of the founding members of ISIF. Alfonso has been Executive Chair Alfonso Farina of Fusion 2006 (Florence, I). Best paper award at Fusion 2005.

Previous teaching experience:
Professor of Radar techniques at the University of Naples, 1979-1985. Several appointments as Teacher at University of Rome, Electronic Engineering Faculty. About 20 tutorials at international radar, fusion and signal processing conferences, over 130 invited papers & presentation & plenary speeches at international conferences. Several tens of lectures at NATO Lectures Series, Seminars, Schools. At present Distinguished Lecturer (DL) of IEEE AESS.

***Biographical sketch of* Luigi Chisci** was born in Florence, Italy, in 1959. He received the degree in Electrical Engineering in 1984 from the University of Florence and the Ph.D. in Systems Engineering in 1989 from the University of Bologna. Currently he is full professor of Control Engineering at the University of Florence since December 2004. His educational and research career have been in the area of control and systems engineering. His research interests have spanned over adaptive control and signal processing, algorithms and architectures for real-time control and signal processing, recursive identification, filtering and estimation, predictive control. His current interests concern networked estimation, multi-target multi-sensor tracking, multi-agent systems and sensor data fusion. He has co-authored over 130 papers of which over 50 on international journals. From 2000 to 2008 he has served the Conference Editorial Board of the IEEE Control Systems Society, as an Associate Editor. He is a senior member of IEEE. He is Associate Editor for the International Journal of Adaptive Control and Signal Processing.

Previous teaching experience:
Full Professor at the University of Florence since 2004, formerly Associate Professor from 1992 and Assistant Professor since 1990, in the area of Control Engineering. He has held more than 50 university courses at bachelor, master and Ph.D. levels in the broad area of control systems engineering covering several topics such as system theory, automatic control systems, estimation, identification, stochastic filtering etc. He also given several presentations and tutorials at international conferences.