



# Tracking and Data Fusion

11-12 August 2010

Presenter: Dr. Branko Ristic, DSTO

Conference Centre Technology Park, Mawson Lakes SA

## Course Topics:

- Introduction, historical survey, theoretical background
- State estimation for stochastic dynamic systems
- Tracking filters: KF, EKF, UKF, particle filter, IMM filter and case studies
- Data association techniques
- Tracking system design issues
- Multiple sensor tracking and fusion
- Fusion-based target ID
- Sensor management
- Decision support systems
- Selected applications
- Literature survey

## About Tracking and Data Fusion

This **two-day** short course is based on the tutorial that was prepared with Dr Alfonso Farina (Scientific Director, SELEX, Italy). The course is a thorough overview of tracking and data fusion for surveillance systems with applications both to defense and civilian systems. Filters are the basic building block of radar defense systems that track targets, provide surveillance, avoid collisions, and guide flight. The most common type of filter is the Kalman filter (KF). For most applications the KF is reliable and efficient, but it is limited to a relatively restricted class of linear Gaussian problems. To solve problems beyond this restricted class, nonlinear filters (such as EKF, UKF, particle filter, IMM) are used. This course introduces the latest advances in nonlinear filters, data association techniques and tracking system designs and examines their application to ballistic missile tracking, GMTI tracking, tracking through the blind Doppler zone and others.

The course will help to develop more accurate and reliable filter designs and more precisely predict these designs' performance. It is intended for those who interested in tracking and radar system designs: engineers, scientists, technicians and others, of military or civil employment.

## About NICTA

National ICT Australia (NICTA) is a national laboratory with a charter to build Australia's pre-eminent Centre of Excellence for information and communication technology (ICT). NICTA is building capabilities in ICT research, education, commercialization, and collaboration in the ICT sector for the generation of national wealth.

NICTA is funded by the Australian Government's Department of Communications, Information Technology and the Arts and the Australian Research Council through *Backing Australia's Ability* and the ICT Centre of Excellence program.

NICTA was established and is supported by its members: The Australian Capital Territory Government; The Australian National University; NSW Department of State and Regional Development; and The University of New South Wales. NICTA is also supported by its partners: the University of Sydney, the University of Melbourne, the Victorian Government, the Queensland Government, Griffith University, Queensland University of Technology, and Queensland University.

## About NICTA short courses

In July 2005 NICTA boosted its education by taking on the short course business of the Cooperative Research Centre for Sensor Signal and Information Processing (CSSIP) and Wedgetail Training, Research and Development Centre (Wedgetail TRDC).

The education model established by CSSIP and Wedgetail TRDC also provides scope for delivering in-house programs tailored to specific needs of organizations. NICTA will continue to hold courses for engineers, scientists, and technicians in industries such as defence, mining, and biotechnology.

The courses will be conducted from 9.00am to 5.00pm. Morning tea will be available at approximately 10.00am to 10.30am, lunch from 12.30pm to 1.30pm and afternoon tea at approximately 3.00pm to 3.30pm.

## Registration Fee:

AU\$1320 (including GST)

Group and PhD student discounts available. Please enquire.

For details of further courses please see our web site:

[www.nicta.com.au/short\\_courses](http://www.nicta.com.au/short_courses)

or contact the NICTA Industry Education Manager.

## Course Topics

**State estimation for stochastic dynamic systems:** optimal Bayesian estimator, linear filters, nonlinear filters, hybrid state estimation, IMM filter, case studies.

**Data association:** gating, (global) nearest neighbour algorithm, (joint) probabilistic data association, multiple hypotheses tracking, multi-dimensional assignment, mixture reduction data association.

**Tracking system design issues:** management of track life stages (initialisation, termination), tracking coordinate systems, performance prediction and evaluation and electronic counter-counter measures.

**Multiple sensor tracking and fusion:** fusion architectures, information graphs, distributed fusion, track association and fusion, registration of multiple sensors.

**Sensor management:** the role of sensor management, optimisation criteria, look-ahead optimisation techniques, case studies.

**Decision support systems:** representation of uncertain attributes and knowledge, combination of evidence, evidential networks, local computation algorithms, applications to target ID and threat assessment.

**Selected applications:** ballistic missile tracking, GMTI radar tracking, angle-only tracking, tracking using TDoA measurements, track-before-detect, bi-static radar tracking, video tracking, wireless sensor networks.

**Literature survey**

## Instructor: Dr. Branko Ristic

Branko Ristic has been involved in R&D projects related to signal processing, estimation, tracking and data fusion for more than 20 years. Dr. Ristic received all of his degrees in electrical engineering: PhD from QUT 1995, M.Sc. Belgrade University 1991, B.Eng. University of Novi Sad 1984. Since 1996, he has been with DSTO, where his role has been to lead, coordinate and participate in research on target tracking and multi-sensor fusion in support of various ADF projects. During his career he has published extensively, and given several invited talks in Europe, USA and Australia.

There will be ample opportunities for discussion and questions and answers. Morning and afternoon tea/coffee and a light lunch will be provided. Extensive workshop materials will be made available to participants.

Please complete the registration form and send it together with your fee,

Anne-Marie Eliseo,  
Industry Education Manager,  
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Mawson Lakes, South Australia, 5095.  
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## Registration Form and Tax Invoice\* ABN 62 102 206 173

\*Upon completion of this form, including the relevant payment, this form will become a Tax Invoice.

**Please register me for Tracking and Data Fusion on 11-12 August 2010.**

PLEASE PRINT

Date: \_\_\_\_\_

Title: \_\_\_\_\_ First Name: \_\_\_\_\_ Surname: \_\_\_\_\_

Position: \_\_\_\_\_ Organisation/Division: \_\_\_\_\_

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Course Fees:

Full fee: AU\$1320 (incl. GST)

Method of Payment (please tick)

Cheque (payable to National ICT Australia Ltd)

**Please forward cheque and a copy of THIS Registration Form to the NICTA Industry Education Manager.**

Credit Card:

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[annette.vanbramer@nicta.com.au](mailto:annette.vanbramer@nicta.com.au)  
when payment is made**

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