Joint Electrical Engineering Institutions' Program 2013

IEEE NSW Section – Joint Chapter Communications/ Signal Processing/ Oceanic Engineering Societies

Marine Science & Ocean Systems Engineering

Date / Time: **Thursday 28th November 2013 6.00pm to 7.00pm** (Light refreshments from 5.30pm)
(The Technical Meeting will be followed by an Administrative Meeting over dinner at Castlereagh Boutique Hotel, 169 Castlereagh St, Sydney. Members and guests are welcome but **RSVP no later than Monday 25th November is essential to** jl.robinson@ieee.org or Tel: **(02) 9418 8695**).

Venue: **Sydney Mechanics' School of Arts**: Mitchell Theatre
Level 1, 280 Pitt Street, Sydney (Near Town Hall; Bathurst Street is nearest cross street)

Speakers: 1. Daniel Bongiorno, DSTO + ACFR Sydney University
2. Eric Ferguson, University of Sydney Institute of Marine Science

Registration essential at : **https://engineersaustralia.wufoo.com/forms/mtu7qxw0e9wjxj/**
confirmation will be provided by email. Seating limited to 142 persons.

First Presentation: *Dynamic Spectral-Based Underwater Colour Correction*

Abstract: Optical sensing in an underwater environment can be challenging due to the complex attenuation and scattering properties of the water. These cause colour changes that are dependent on factors such as the constituents within the water, sunlight/weather changes and distance to the object of interest. It is desirable to correct for the water's influence so as to recover a true reflectance/colour of the imaged scene. This is necessary in the application of benthic mapping where producing inter- and intra-site colour consistent images is important for classification and characterisation of these habitats. A new method is presented which involves sensing the incoming irradiance to the scene from two locations above and below the water and colour correcting the image. The light is sensed in the hyperspectral domain, leading to other uses in the examination of the water column. We present colour correction in the trichromatic domain but this is equally applicable in the hyperspectral domain.

Second Presentation: *Sensors, Signals and Algorithms for Passively Localising Dolphins in the Wild*

Abstract: Sequences of biosonar click transmissions, which are emitted by *Tursiops aduncus* dolphins while swimming freely in their natural habitat, are recorded by a linear array of four widely spaced hydrophones located 1 m above the sea floor in water 20 m deep in Jervis Bay. In this presentation, the hydrophone array output data for click sequences from seven echolocating dolphins (including three dolphins echolocating at the same time) are processed to estimate the position of each dolphin. The experimental results are found to agree with the theoretical localisation performance of a wide aperture array passive ranging sonar. For example, the standard deviation of the bearing errors are about 0.005° (independent of range), whereas the standard deviations of the range errors increase a hundred fold from 2.5 cm to 2.6 m for a tenfold increase in the source range from 33 m to 318 m. Also, consistent with the theoretical prediction for localising a stationary source, the source position estimates (of the detrended data) are observed to be bounded by a range-bearing uncertainty ellipse, with the eccentricity of the ellipse being highly range dependent. The source localisation method is then extended from two- to three-dimensions by applying a single sensor multipath time delay method to estimate the source altitude to within ±5 cm. These methods represent powerful nonintrusive scientific tools for studying the behaviour of echolocating dolphins in the wild as they offer unprecedented precision in localising dolphins and are able to discern individual dolphins within a pod, even at long ranges.

Note: Attendance may be credited towards Engineers Australia's Continuing Professional Development (CPD)

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