

Department of Biomedical Engineering

Seminar Series

Optimal Path Planning and Sensor Placement for Mobile Target Detection

Brian D. O. Anderson

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Emeritus Professor, Australian National University and
Distinguished Researcher, Data 61 CSIRO, Australia

Date:	February 15, 2019 (Friday)
Time:	2:30pm - 3:30pm
Venue:	Rm Y6405 CS Seminar Room, 6/F, Yeung Kin Man Academic Building (Lift No.9)

Abstract

This talk describes an applications problem originating from Australia's Defence Science and Technology Organization, in which a variety of modeling and optimization issues present themselves. For a flying military vehicle, in many scenarios avoiding detection is a key objective. Given a field of heterogeneous detectors such as radars in fixed positions, flying the least probability of detection path through the field of detectors is a fundamental strategy. Most previous optimization methods for this problem have sought to minimize cumulative radar exposure; in contrast, we consider a formulation that directly minimizes the probability of detection. We show how a variational dynamic

programming method can be applied to this model to allow one to find a locally optimal path with low computational complexity, and then extend the idea in two directions. First, using homotopy methods, we consider how the vehicle can cope with adjustments to the detector field, resulting from introduction or removal of detectors, or changes of sensitivity. Then we consider the effect of taking Doppler measurements into account. This poses a challenge both in terms of modeling, and an increase in the dimension of the problem.

From the point of view of those seeking to detect the vehicle, the positioning of sensor assets is important. The talk considers how this can be done when the vehicle whose detection is desired optimizes its path. A relaxed version of the positioning problem can be formulated as a convex optimization problem and used to determine optimal or close-to-optimal detector positions.

Biography

Brian D. O. Anderson was born in Sydney, Australia, and educated at Sydney University in mathematics and electrical engineering, with PhD in electrical engineering from Stanford University. Following graduation, he joined the faculty at Stanford University and worked as Vidar Corporation of Mountain View, California. He then returned to Australia to become a department chair in electrical engineering at the University of Newcastle. From there, he moved to the Australian National University in 1982, as the first engineering professor at that university. He became an emeritus professor at ANU in July 2016 and Distinguished Professor at Hangzhou Dianzi University, China, and a Distinguished Researcher in Data 61 CSIRO (previously NICTA, National ICT Australia). During his period in academia, he spent significant time working for the Australian Government, with this service including membership of the Prime Minister's Science Council under the chairmanship of three prime ministers, and he was the

inaugural President of NICTA. He also served on advisory boards or boards of various companies, including the board of the world's major supplier of cochlear implants, Cochlear Corporation, where he was a director for ten years. He has won many awards and medals, and is a Fellow of the Australian Academy of Science, Australian Academy of Technological Sciences and Engineering, Royal Society (London), and a foreign member of the US National Academy of Engineering. He holds honorary doctorates from a number of universities, including Université Catholique de Louvain, Belgium, and ETH, Zürich. He served as IFAC President from 1990 to 1993, and was also President of the Australian Academy of Science from 1998 to 2002. His current research interests are in distributed and networked control and econometric modelling.

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All are Welcome!

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