

SEMINAR ANNOUNCEMENT

Monday December 2nd, 2019, Time:10.30-11.30
Aula Seminari DIETI, 1st floor, building 3/A - Via Claudio, 21 NAPOLI

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MARKED POINT PROCESSES FOR OBJECT DETECTION AND TRACKING IN HIGH RESOLUTION IMAGES: APPLICATION TO REMOTE SENSING DATA

Abstract — In this talk, we combine the methods from probability theory and stochastic geometry to put forward new solutions to the multiple object detection and tracking problem in high resolution remotely sensed image sequences. First, we present a spatial marked point process model to detect a pre-defined class of objects based on their visual and geometric characteristics. Then, we extend this model to the temporal domain and create a framework based on spatio-temporal marked point process models to jointly detect and track multiple objects in image sequences. We propose the use of simple parametric shapes to describe the appearance of these objects. We build new, dedicated energy based models consisting of several terms that take into account both the image evidence and physical constraints such as object dynamics, track persistence and mutual exclusion. We construct a suitable optimization scheme that allows us to find strong local minima of the proposed highly non-convex energy.

As the simulation of such models comes with a high computational cost, we turn our attention to the recent filter implementations for multiple objects tracking, which are known to be less computationally expensive. We propose a hybrid sampler by combining the Kalman filter with the standard Reversible Jump MCMC. High performance computing techniques are also used to increase the computational efficiency of our method. We provide an in-depth analysis of the proposed framework based on standard multiple object tracking metrics and computational efficiency. This analysis yields a very good detection and tracking performance at the price of an increased complexity of the models. Exhaustive tests have been conducted on various high-resolution satellite sequences.



Biosketch — **Josiane Zerubia** has been a permanent research scientist at INRIA since 1989 and director of research since July 1995 (DR 1st class since 2002). She was head of the Ariana research group (INRIA/CNRS/University of Nice) from 1998 to 2011, and head of the Ayin research group (INRIA-SAM) from 2012 to 2016. She has been professor (PR1) at SUPAERO (ISAE) in Toulouse since 1999. She received the MSc degree from the University of Grenoble (F) in 1981, the Doctor of Engineering degree, her PhD and her 'Habilitation', in 1986, 1988, and 1994 respectively, all from the University of Nice Sophia-Antipolis (F). She is a Fellow of both the IEEE (2003-) and EURASIP (2019), and was IEEE SP Society Distinguished Lecturer (2016-2017). Her main research interest is in image processing using probabilistic models. She also works on parameter estimation, statistical learning and optimization techniques, and artificial intelligence.