Ecole Doctorale STIC

Sciences & Technologies de l'Information et de la Communication

MINES ParisTech

Université Nice SOPHIA ANTIPOLIS

ED STIC - Proposition de Sujets de Thèse

pour la campagne d'Allocation de thèses 2015

Axe Sophi@Stic :	BioSanté|
Titre du sujet :	Multiple particle tracking using data association
Mention de thèse :	ATSI
HDR Directeur de thèse inscrit à l'ED STIC :	Xavier Descombes

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Description du sujet :

Object has been widely studied since the famous Kalman filter. In case of multiple objects this problem becomes particularly challenging due to several phenomena such as appearance or disappearance of an object at some instant, trajectory crossing. To solve this problem two main approaches are usually considered. The first approach consists of objects detection at time 0 and tracking this set of initially detected objects. In the second, objects are detected at each instant and the trajectories are recovered by solving a data association problem. In this internship we will consider the second case to consider appearance (birth process) and disappearance (death process) at each instant.

The goal of the developed approach is to handle false alarms and miss detection. Therefore, we will consider a sequential Monte Carlo approach. We target applications that embed huge datasets so that the computational time becomes a crucial issue. To avoid computational

complexity linked with sampling we will first consider a Rao-Blackwellized Monte Carlo Data Association approach as described in [1] combining Kalman or extended Kalman filtering with importance sampling. To construct the posterior we will consider the problem of vesicles tracking within cells from microscopy images and the problem of axon tips tracking during axon growth. For both applications, specific kinetic models will be proposed.
The resulting algorithm will be validated on real data obtained from confocal and two-photon microscopy. The biological applications will be conducted in collaboration with iBV (Institute of Biology of Valrose).
[1] Rao-Blackwellized particle filter for multile target tracking. S. Särkkä, A. Vehtari, J. Lampinen. Information Fusion 8(2007) 2-15.

English version:

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