Fall Colloquium

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Seitz 313

Fabrizio Ruggeri,
CNR IMATI, Milano, Italy.

(Joint work with Anthony Ebert, Kerrie Mengersen, Paul Wu, Antonietta Mira and Ritabrata Dutta)

Fast and Likelihood-Free Parameter Estimation for Dynamic Queueing Networks
The case of the immigration queue at an international airport

Keywords: Approximate Bayesian Computation; Dynamic Queueing Networks; Airport arrivals.

Many complex real-world systems such as airport terminals, manufacturing processes and hospitals are modelled with networks of queues. To estimate parameters, restrictive assumptions are usually placed on these models. For instance, arrival and service distributions are assumed to be time-invariant. Violating this assumption are so-called dynamic queueing networks (DQNs) which are more realistic but do not allow for likelihood-based parameter estimation.

We consider the problem of using data to estimate the parameters of a DQN. The is the first example of Approximate Bayesian Computation (ABC) being used for parameter inference of DQNs. We combine computationally efficient simulation of DQNs with ABC and an estimator for maximum mean discrepancy. DQNs are simulated in a computationally efficient manner with Queue Departure Computation (a simulation technique we are proposing), without the need for time-invariance assumptions, and parameters are inferred from data without strict data-collection requirements. Forecasts are made which account for parameter uncertainty. We embed this queueing simulation within an ABC sampler to estimate parameters for DQNs in a straightforward manner. We motivate and demonstrate this work with the example of passengers arriving at the passport control in an international airport.

Relevant paper: https://arxiv.org/a/ebert_a_1.html