Dissertation for the Faculty of Computer Science (FIN),
Otto von Guericke University (OVGU), Magdeburg

Data Confidentiality for Distributed Sensor Fusion

Marko Ristic

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Reviewers:

Prof. Dr.-Ing. Benjamin Noack (OVGU, Magdeburg, Germany)

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Acknowledgements

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Abstract

Distributed sensing and fusion algorithms are increasingly present in public computing networks and have led to a natural concern for data security in these environments. This thesis aims to present generalisable data fusion algorithms that simultaneously provide strict cryptographic guarantees on user data confidentiality. While fusion algorithms providing some degrees of security guarantees exist, these are typically either provided at the cost of solution generality or lack formal security proofs. Here, novel cryptographic constructs and state-of-the-art encryption schemes are used to develop formal security guarantees for new and generalised data fusion algorithms. Industry standard Kalman filter derivates are modified and existing schemes abstracted such that novel cryptographic notions capturing the required communications can be formalised, while simulations provide an anlysis of practicality. Due to the generality of the presented solutions, broad applications are supported, including autonomous vehicle communications, smart sensor networks and distributed localisation.

Kurzfassung

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Notation

Complete notation here.

1. Introduction

Data fusion and state estimation growing in application

Growing distributed networks have put a greater stress on the need for broadly applicable data fusion algorithms that support processing of different types of measurements and estimates with different accuracies and avilabilities

examples

The use of Bayesian estimation methods, in particular the popular Kalman filter and its non-linear derivatives have found particularly prevalent applications due to their recursive and often optimal estimation properties and their suitability to modelling measurement cross correlations typically required for fusion

Challenges in estimation a closely related to the handling and merginig of estimation error statistics

Cross correlations between estimation errors characterise dependencies between local estimations and must be considered whenperforming consistent or optimal fusion

along with error statistic challenges the ... public networks ... new challenges betcoming increasingly important ... security

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