Dissertation for the Faculty of Computer Science (FIN),
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Data Confidentiality for Distributed Sensor Fusion

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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

German abs goes here.

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

The filters also allow modelling of cross correlations between local estimates, a common cause of challenges in estimation theory, and a requirement for consistent or optimal fusion.

While the challenges faced due to the correlations between error statistics have existed for some time and have been well studied, the advancements in distributed algorithms, cloud computing and public networks are bringing additional security oriented challenges to estimation solutions.

privacy and security

can use normal RSA and AES

more complicated examples

more complicated schemes

leads us into the state-of-the-art

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