



DOCTOR OF PHILOSOPHY (Ph.D.)

THESIS REFEREE'S REPORT

Candidate's Name:	Ing. Martine Flusser
Thesis Title:	Mathematical Modeling of Anomalies in Large-Scale Vector and Structural Data
Referee's Name:	Prof. Mineichi Kudo
Referee's Institution	Hokkaido University, Japan

This Thesis Referee's Report consists of TWO parts:

PART 1: RESEARCH QUALITY AND THESIS PRESENTATION

PART 2: RECOMMENDATION

PART 1: RESEARCH QUALITY AND THESIS PRESENTATION

1. What are the methods applied in the thesis.

The subject dealt with in this thesis is anomaly detection (shortly, AD), especially in cyber security. The research goal of this thesis is to bring more scalability while keeping the best accuracy attained so far. The idea is to simulate the best AD algorithm by a surrogate neural network (shortly, SNN). The proposed algorithm succeeded in attaining this goal experimentally in several artificial and real datasets.

2. How much the topic of the thesis is up to date.

AD is one of most important issues in industry currently. Many algorithms have been proposed so far for AD, there is a trade-off between the computational cost and the accuracy. The dissertation submitter solved this problem by a novel approach, SNNs. In addition, the fundamental algorithm is extended for online learning and for multiple instance learning, widening the applicability.

3. Whether the goal of the thesis has been achieved.

Yes, it has. It was clearly a good proposal, and the effectiveness was confirmed quantitatively by several experiments.

4. What is the scientific value of the results.

The impact is quite large and more importantly the proposed algorithm is practical. Many applications would be thankful to the proposed algorithms.

5. Comments on the thesis.

This thesis is well written. The fundamental and extended algorithms are all very contributable to many industrial applications. If possible, it would be better if some ideas are discussed for gaining a better accuracy than the density-based source detector.



PART 2: RECOMMENDATION

The Referee shall recommend for *presentation and defense*.

Prof. Mineichi Kudo

A handwritten signature in blue ink, appearing to read "Mineichi Kudo", written over a horizontal line.

Signature of Examiner

25 July 2023

Date