

論文 / 著書情報
Article / Book Information

題目(和文)	データストリームを用いた継続学習のための自己増殖型ニューラルネットワーク
Title(English)	Self-Organizing Incremental Neural Networks for Continual learning from Data Streams
著者(和文)	シャユット ウィワッチャラコーセース
Author(English)	Chayut Wiwatcharakoses
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第11418号, 授与年月日:2020年3月26日, 学位の種別:課程博士, 審査員:BERRAR DANIEL PETER,蜂屋 弘之,倉林 大輔,藤田 政之,植松 友彦
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学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

系・コース： システム制御 系
Department of Graduate major in コース
学生氏名： Chayut Wiwatcharakoses
Student's Name

申請学位 (専攻分野)： 博士 Engineering
Academic Degree Requested Doctor of
指導教員 (主)： Dr. Daniel Berrar
Academic Supervisor(main)
指導教員 (副)：
Academic Supervisor(sub)

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

The doctoral thesis entitled “Self-Organizing Incremental Neural Networks for Continual Learning from Data Streams” has the objective to develop innovative machine learning methods for continual supervised and unsupervised learning from noisy data streams. The thesis consists of six chapters. The contents are summarized as follows.

Chapter 1, “Introduction”, describes the research background of the doctoral research. This chapter first outlines the different paradigms of machine learning. Then, the research rationale is presented and the research goals are clearly defined. The chapter ends with an outline of the novel contributions and the overall organization of the thesis.

Chapter 2, “Related Work”, describes earlier work in the context of continual learning. The different approaches to preventing catastrophic forgetting in intelligent learning systems are described and compared. Then, the chapter summarizes the previous versions of self-organizing incremental neural networks (SOINN).

Chapter 3, “Text Localization: an Application for Continual Learning”, gives an example of a continual learning task in a real-world context: the automatic identification of text in images. This chapter presents a novel two-pass clustering technique, its mathematical details and algorithmic implementation, and its empirical evaluation.

Chapter 4, “SOINN+, a Self-Organizing Incremental Neural Network for Unsupervised Learning from Noisy Data Streams”, is the central part of this thesis. This chapter describes a novel self-organizing incremental neural network that is fundamentally different from previous generations of SOINN with respect to how “forgetting” is modeled. In contrast to previous SOINN which delete nodes and edges at fixed intervals, “forgetting” is an intrinsic part of the learning process. SOINN+ is an unsupervised method that can detect clusters of arbitrary shapes in noisy data streams. The chapter describes the mathematical details and algorithms for constructing the network. The chapter also presents several benchmark experiments and comparisons with stream clustering algorithms.

Chapter 5, “GSOINN+, a Self-Organizing Incremental Neural Network for Cross-Domain Continual Supervised Learning”, presents the extension of SOINN+ to supervised learning. In GSOINN+, the new concept of ghost nodes is developed, which are virtual nodes in the network that carry information about class labels but play no role in the network evolution. GSOINN+ was evaluated in several benchmark experiments involving sequential learning tasks. GSOINN+ was compared with two related methods, the Associative Grow When Required network and the Associative Gamma Grow When Required network. GSOINN+ could adapt to completely new classification tasks without catastrophic forgetting and maintain a high accuracy.

Chapter 6, “Discussion and Conclusions”, summarizes the contents of the thesis, presents an in-depth discussion of the proposed methods, and discusses the novel contributions. The chapter also gives an outlook at future work.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note：Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).

注意：論文要旨は、東工大リサーチリポジトリ(T2R2)にてインターネット公表されますので、公表可能な範囲の内容で作成してください。

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