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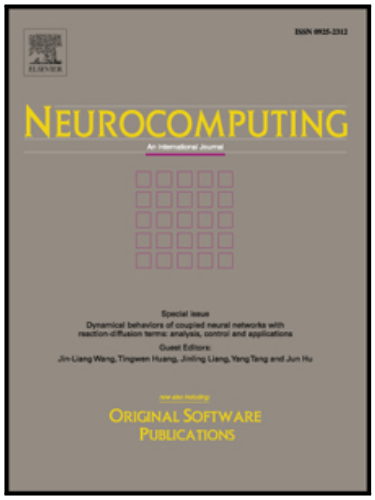

Robust mixture of experts modeling using the skew t distribution

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ACCEPTED MANUSCRIPT

Robust mixture of experts modeling using the skew t distribution

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Abstract

Mixture of Experts (MoE) is a popular framework in the fields of statistics and machine learning for modeling heterogeneity in data for regression, classification and clustering. MoE for continuous data are usually based on the normal distribution. However, it is known that for data with asymmetric behavior, heavy tails and atypical observations, the use of the normal distribution is unsuitable. We introduce a new robust non-normal mixture of experts modeling using the skew t distribution. The proposed skew t mixture of experts, named STMoE, handles these issues of the normal mixtures experts regarding possibly skewed, heavy-tailed and noisy data. We develop a dedicated expectation conditional maximization (ECM) algorithm to estimate the model parameters by monotonically maximizing the observed data log-likelihood. We describe how the presented model can be used in prediction and in model-based clustering of regression data. Numerical experiments carried out on simulated data show the effectiveness and the robustness of the proposed model in fitting non-linear regression functions as well as in model-based clustering. Then, the proposed model is applied to the real-world data of tone perception for musical data analysis, and the one of temperature anomalies for the analysis of climate change data. The obtained results confirm the usefulness of the model for practical data analysis applications.

Keywords: mixture of experts, skew t distribution; EM algorithm; ECM algorithm; non-linear regression; model-based clustering.

1. Introduction

Mixture of Experts (MoE) (Jacobs et al., 1991) is a popular framework in the statistics and machine learning fields for modeling heterogeneity in data for regression, classification and clustering. They consist in a fully conditional mixture model where both

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