Continuous States Conditional Random Fields Training Using Adaptive Integration

Submitted by

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I certify that all material in this thesis which is not my own work has been identified and that no material has previously been submitted and approved for the award of a degree by this or any other University.

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Abstract

The extension of Conditional Random Fields (CRF) from discrete states to continuous states will help remove the limitation of the number of states and allow new applications for CRF.

In this work, our attempts to obtain a correct procedure to train continuous state conditional random fields through maximum likelihood are presented. By deducing the equations governing the extension of the CRF to continuous states it was possible to merge with the Particle Filter (PF) concept to obtain a formulation governing the training of continuous states CRFs by using particle filters. The results obtained indicated that this process is unsuitable because of the low convergence of the PF integration rate in the needed integrations replacing the summation in CRFs. So a change in concept to an adaptive integration scheme was made.

Based on an extension of the Binary Space Partition (BSP) algorithm an adaptive integration process was devised with the aim of producing a more precise integration while retaining a less costly function evaluation than PF. This allowed us to train continuous states conditional random fields with some success.

To verify the possibility of increasing the dimension of the states as a vector of continuous states a scalable version was also used to briefly assess its fitness in two-dimensions with quadtrees. This is an asymmetric two-dimensional space partition scheme.

In order to increase the knowledge of the problem it would be interesting to have further information of the relevant features. A feature selection embedded method was used based on the lasso regulariser with the intention of pinpointing the most relevant feature functions indicating the relevant features.

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