Gesture Alignment Using Hidden Markov Models

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Stanford University
CS228: Probabilistic Graphical Methods - Winter 2011

Abstract

SALMAN:

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1 Introduction

SALMAN:

Kinect, data, problem setup, main goal (align gestures, why this is necessary for classification).

2 Related Work

ANDREW:

Dynamic Time Warping [Listgarten *et al.*, 2005]
Learning Control [Coates *et al.*, 2008]
Probabilistic Graphical Models: Principles and Techniques [Koller and Friedman, 2009]
Dynamic Bayesian Networks: Representation, Inference and Learning [Murphy, 2002]
Hidden Conditional Random Fields for Gesture Recognition [Wang *et al.*, 2006]

3 Graphical Model

SALMAN:

images of the model before and after dynamic programming approach to DTW
It's an alignment HMM

4 Algorithm

ANDREW:

What we did: EM, DTW
Optimizing the algorithm when calculating q(:,:), tau;
Different smoothing
no prior knowledge of optimal trajectory
not using a bias function
Tried different allowed step sizes for d

5 Results

SALMAN:

Figures, writeup (we are geniuses).

6 Discussion and Future Work

ANDREW:

Why didn't it work very well? Smoothing made things worse.
Use different smoothing
Add prior knowledge of optimal trajectory: can incorporate effects of gravity - don't want things to hang in mid air.
Application to classification problem
Add more data (training data)
Add features to detect particular aspects of gestures.
Detect orientation differences

7 Conclusion

SALMAN:

References

[Coates *et al.*, 2008] Adam Coates, Pieter Abbeel, and Andrew Y. Ng. Learning for control from multiple demonstrations. In *Proceedings of the 25th international conference on Machine learning*, ICML '08, pages 144–151, New York, NY, USA, 2008. ACM.

[Koller and Friedman, 2009] D. Koller and N. Friedman. *Probabilistic Graphical Models: Principles and Techniques*. MIT Press, 2009.

[Listgarten *et al.*, 2005] Jennifer Listgarten, Radford M. Neal, Sam T. Roweis, and Andrew Emili. Multiple alignment of continuous time series. In *in Advances in Neural Information Processing Systems*, pages 817–824. MIT Press, 2005.

[Murphy, 2002] Kevin Patrick Murphy. Dynamic bayesian networks: Representation, inference and learning, 2002.

[Wang *et al.*, 2006] Sy Bor Wang, A. Quattoni, L.-P. Morency, D. Demirdjian, and T. Darrell. Hidden conditional random fields for gesture recognition. In *Computer Vision and Pattern Recognition, 2006 IEEE Computer Society Conference on*, volume 2, pages 1521 – 1527, 2006.