

DP-GP-LVM

A Bayesian Non-Parametric Model for Learning Multivariate Dependency Structures

Andrew R. Lawrence¹ Carl Henrik Ek² Neill D. F. Campbell¹

¹University of Bath, UK

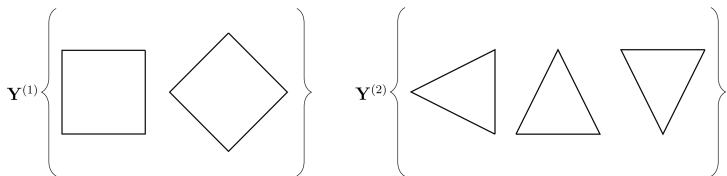


²University of Bristol, UK

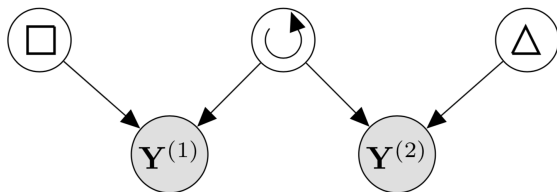
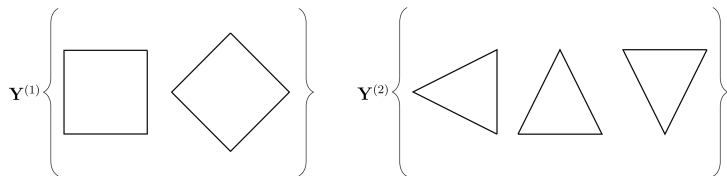


Proceedings of the 36th International Conference on Machine Learning
Long Beach, California, USA
12 June 2019

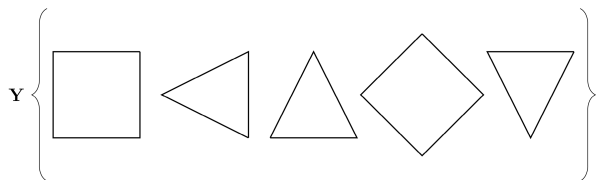
Motivation



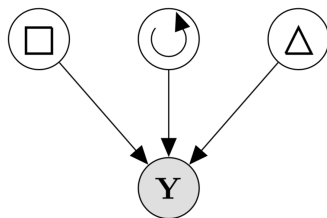
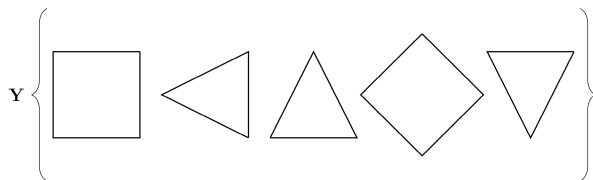
Motivation



Motivation

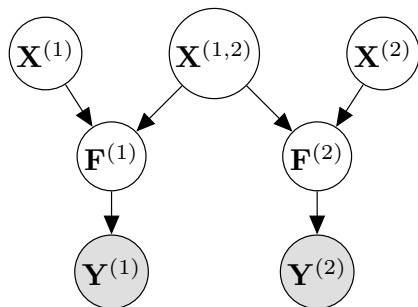


Motivation



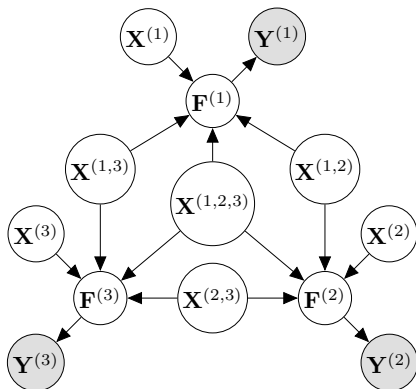
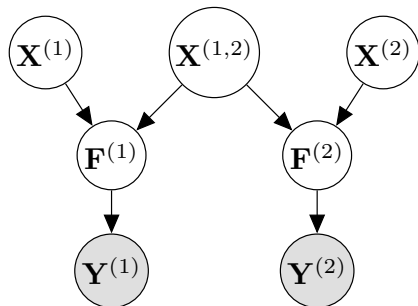
Background

Factorized Gaussian Process Latent Variable Model (GP-LVM) [1, 2]



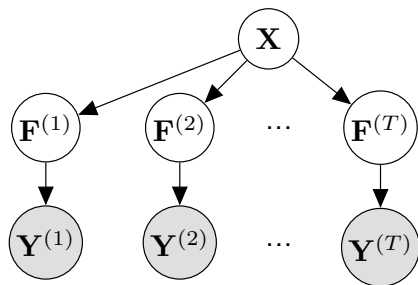
Background

Factorized Gaussian Process Latent Variable Model (GP-LVM) [1, 2]



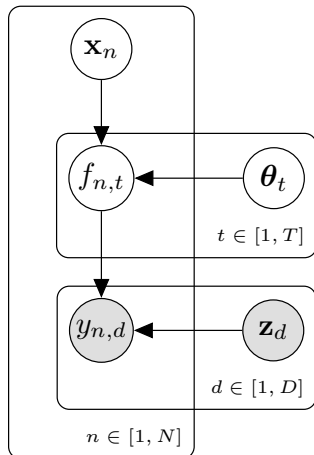
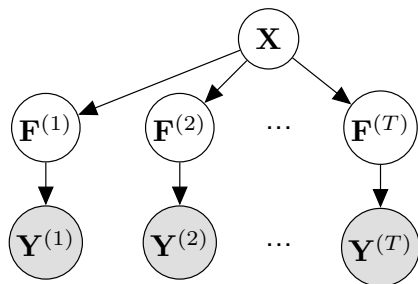
Background

Manifold Relevance Determination (MRD) [3]



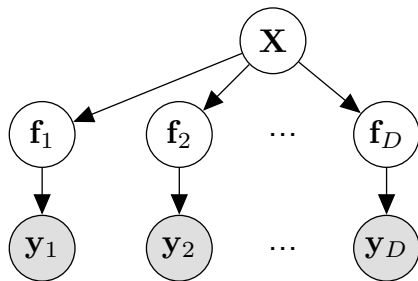
Background

Manifold Relevance Determination (MRD) [3]



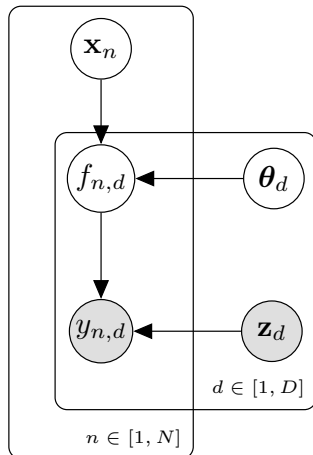
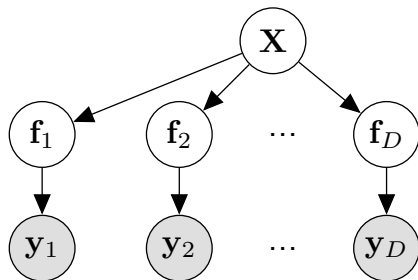
Background

Fully Independent MRD (fi-MRD) [3]

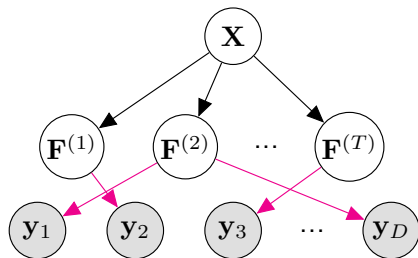


Background

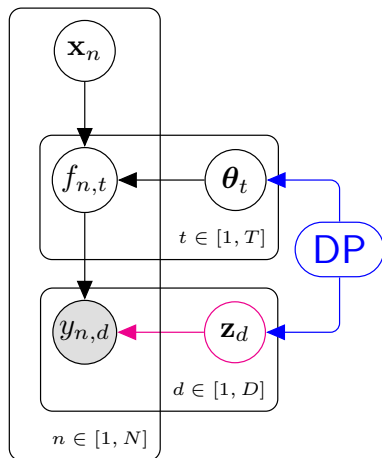
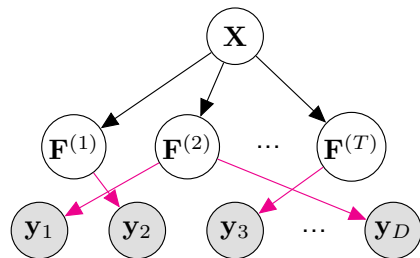
Fully Independent MRD (fi-MRD) [3]



DP-GP-LVM

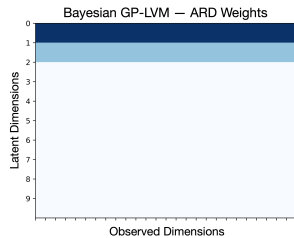


DP-GP-LVM



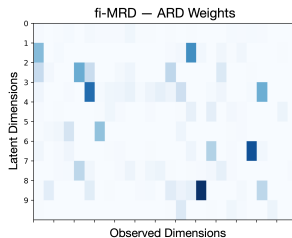
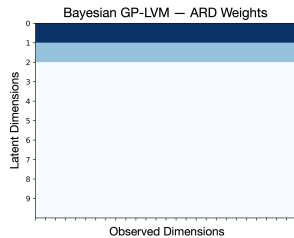
Experiments

PoseTrack [4] – Two People



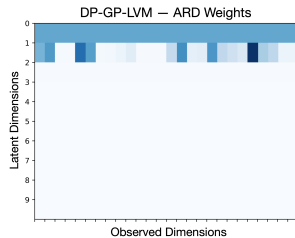
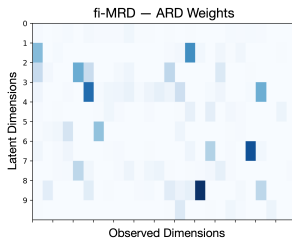
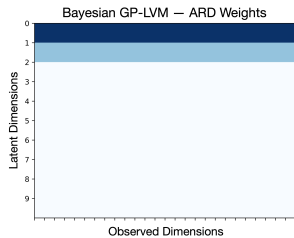
Experiments

PoseTrack [4] – Two People



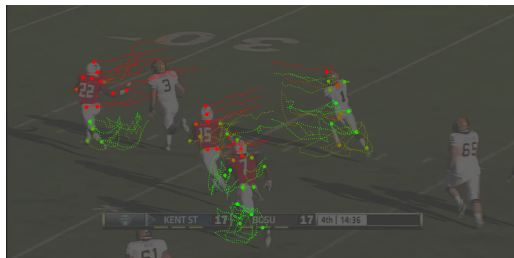
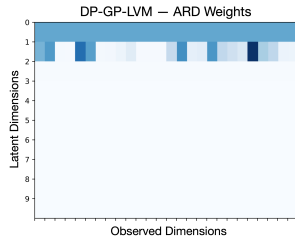
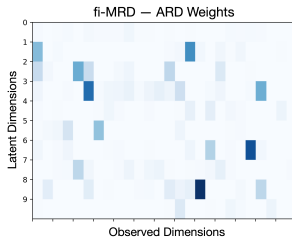
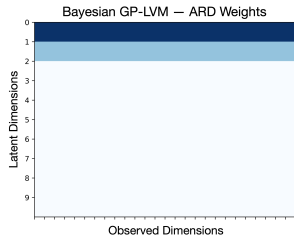
Experiments

PoseTrack [4] – Two People



Experiments

PoseTrack [4] – Two People




Experiments

PoseTrack [4] – Missing Data


\bar{N} Missing (%)	10	10	10	20	20	20
\bar{D} Missing (%)	10	20	30	10	20	30
	PoseTrack 2 Person					
BGP-LVM [5]	-50.02 ± 12.32	-93.39 ± 18.84	-157.67 ± 32.20	-61.64 ± 13.95	-134.08 ± 22.73	-191.90 ± 33.57
fi-MRD [3]	-40.62 ± 10.64	-109.73 ± 17.36	-138.67 ± 14.84	-54.92 ± 8.51	-149.36 ± 11.36	-248.89 ± 36.79
DP-GP-LVM	-18.11 ± 0.48	-35.83 ± 0.44	-54.07 ± 0.49	-52.28 ± 0.29	-104.76 ± 0.47	-158.4 ± 0.81
	PoseTrack 4 Person					
BGP-LVM [5]	-121.06 ± 24.10	-189.52 ± 34.73	-358.36 ± 52.06	-102.98 ± 24.06	-209.79 ± 37.35	-322.79 ± 59.27
fi-MRD [3]	-28.55 ± 0.73	-56.45 ± 1.34	-123.47 ± 27.63	-73.89 ± 1.23	-147.42 ± 2.03	-270.04 ± 45.07
DP-GP-LVM	-28.14 ± 0.92	-55.44 ± 1.69	-107.41 ± 2.61	-71.80 ± 1.87	-143.06 ± 3.26	-311.39 ± 1.31


References

 Carl Henrik Ek, J Rihan, Phil H. S. Torr, G Rogez, and Neil D Lawrence.
Ambiguity modeling in latent spaces.
Int. Conference on Machine Learning for Multimodal Interaction, 2008.

 Mathieu Salzmann, Carl Henrik Ek, Raquel Urtasun, and Trevor Darrell.
Factorized orthogonal latent spaces.
In Proceedings of the Thirteenth International Conference on Artificial Intelligence and Statistics, pages 701–708, 2010.

 Andreas C. Damianou, Carl Henrik Ek, Michalis K. Titsias, and Neil D. Lawrence.
Manifold relevance determination.
In International Conference on Machine Learning (ICML), 2012.

 M. Andriluka, U. Iqbal, E. Ensafutdinov, L. Pishchulin, A. Milan, J. Gall, and Schiele B.
PoseTrack: A benchmark for human pose estimation and tracking.
In CVPR, 2018.

 Andreas C. Damianou, Michalis K. Titsias, and Neil D. Lawrence.
Variational inference for latent variables and uncertain inputs in Gaussian processes.
Journal of Machine Learning Research, 17(1):1425–1486, January 2016.

Thank You

Poster #221

Pacific Ballroom - 12 June 2019 - 18:30–21:00

Acknowledgements

We would like to acknowledge the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 665992, the UK's EPSRC Centre for Doctoral Training in Digital Entertainment (CDE, EP/L016540/1), the RCUK-funded Centre for the Analysis of Motion, Entertainment Research and Applications (CAMERA, EP/M023281/1), and the Royal Society for supporting this research.

