Conferencia invitada

Probabilistic Dimensional Reduction

with the Gaussian Process

Latent Variable Model

por

Dr. Neil Lawrence
Senior Research Fellow, University of Manchester

Abstract:

Density modelling in high dimensions is a very difficult problem. Traditional approaches, such as mixtures of Gaussians, typically fail to capture the structure of data sets in high dimensional spaces. In this talk we will argue that for many data sets of interest, the data can be represented as a lower dimensional manifold immersed in the higher dimensional space. We will then present the Gaussian Process Latent Variable Model (GP- LVM), a non-linear probabilistic variant of principal component analysis (PCA) which implicitly assumes that the data lies on a lower dimensional space. Having introduced the GP-LVM we will review extensions to the algorithm, including dynamics, learning of large data sets and back constraints. We will demonstrate the application of the model and its extensions to a range of data sets, including human motion data, a vowel data set and a robot mapping problem.

Related papers:

[1]   N. D. Lawrence (2005) "Probabilistic non-linear principal component analysis with Gaussian process latent variable models" in Journal of Machine Learning Research 6, pp 1783—1816.

[2]   N. D. Lawrence (2007) "Learning for larger datasets with the Gaussian process latent variable model" in M. Meila and X. Shen (eds) Proceedings of the Eleventh International Workshop on Artificial Intelligence and Statistics, Omnipress, San Juan, Puerto Rico.

[3]   B. D. Ferris, D. Fox and N. D. Lawrence. (2007) "WiFi-SLAM using Gaussian process latent variable models" in M. M. Veloso (ed.) Proceedings of the 20th International Joint Conference on Artificial Intelligence (IJCAI 2007).

[4]   N. D. Lawrence and A. J. Moore. (2007) "Hierarchical Gaussian process latent variable models" in Z. Ghahramani (ed.) Proceedings of the International Conference in Machine Learning, Omnipress.

[5]   N. D. Lawrence and J.Quiñonero Candela. (2006) "Local distance preservation in the GP-LVM through back constraints" in W. Cohen and A. Moore (eds) Proceedings of the International Conference in Machine Learning, Omnipress.

[6]   N. D. Lawrence (2004) "Gaussian process models for visualisation of high dimensional data" in S. Thrun, L. Saul and B. Schölkopf (eds) Advances in Neural Information Processing Systems, MIT Press, Cambridge, MA.

Biography:

Neil Lawrence is a Senior Research Fellow in the School of Computer Science at the University of Manchester, U.K.. Previous to this appointment he was a Senior Lecturer in the Department of Computer Science at the University of Sheffield, U.K. where he was head of the Machine Learning Research Group. His main research interest is machine learning through probabilistic models. He is interested in both the algorithmic side of these models and their application in areas such as bioinformatics, speech, vision and graphics.

His PhD was awarded in 2000 from the Computer Lab at the University of Cambridge. He then spent a year at Microsoft Research, Cambridge before moving to Sheffield in 2001 and then to Manchester in 2007.

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Día: 5 de julio de 2007
Hora: 16:00
Lugar: Sala 4.3.A.05
        Edificio Torres Quevedo
        Universidad Carlos III de Madrid
        Campus de Leganés
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