

Topic:

## Factor Graphs in Wireless Communication: Theory and Practice



Presenter:

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Date:

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Location:

Johannes Kepler University Linz (MT327)



Abstract:

In this two-part tutorial, we will cover the theory behind Bayesian graphical models as well as some practical applications. A background in probability theory and digital communications is recommended.

In Part I, we start with the three basic problems in Bayesian inference and highlight the computational issues that arise in high dimensions. We then introduce factor graphs as a way to represent high-dimensional distributions. On these factor graphs, we can execute a variety of message passing algorithms, such as sum-product, max-sum, and mean-field. We will connect each of these message passing algorithms with the basic problems in Bayesian inference. By means of a variational interpretation, we demonstrate how message passing algorithms can be interpreted, and how new message passing algorithms may be developed. We conclude with a discussion regarding convergence and distributed processing.

In Part II, we will apply factor graphs to three practical problems:

- (i) receiver design (including equalization, demodulation, and decoding);
- (ii) synchronization;
- (iii) cooperative processing in networks.

This part of the tutorial will contain do-it-yourself problems to get hands-on experience. Time permitting, we will give an overview of where factor graphs are currently being applied on the field of communication theory.

Biography:

Henk Wymeersch is an Assistant Professor with the Department of Signals and Systems at Chalmers University of Technology, Sweden. He is also affiliated with the FORCE research center on fiber-optic communication, and is the PI of COOPNET, an ERC project on cooperative networks. Prior to joining Chalmers, he was a Postdoctoral Associate during 2006-2009 with the Laboratory for Information and Decision Systems (LIDS) at the Massachusetts Institute of Technology (MIT). Henk Wymeersch obtained the Ph.D. degree in Electrical Engineering/Applied sciences in 2005 from Ghent University, Belgium. For his thesis, he won the 2006 Alcatel Bell Scientific Award. He received a fellowship from the Belgian American Educational Foundation in 2005-2006. He is a member of the IEEE, Associate Editor for IEEE Communication Letters, for the Journal of Computer Systems, Networks, and Communications, and the European Transactions on Telecommunication (ETT). He served as Guest Editor for EURASIP Journal on Wireless Communications and Networking (special issue on Localization in Mobile Wireless and Sensor Networks). He has co-authored over 80 contributions in journals and international conferences, and is the author of *Iterative Receiver Design* (Cambridge University Press, August 2007). In 2009, he was part of a team that won the L3 Communications Prize at the 2009 Soldier Design Competition, for the practical demonstration of cooperative ultra-wide bandwidth (UWB) localization. Other awards include a best paper award at Globecom 2009 and a NEWCOM++ best paper award in 2010. His research interests include algorithm design for wireless transmission, statistical inference and iterative processing.

Registration:

We ask for a registration (free of charge) to help us with the organisation.

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