Tim Genewein

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RESEARCHER
BOSCH CENTER FOR ARTIFICIAL INTELLIGENCE

Research

Two current challenges in deep learning are: massive computational demands and lack of well behaved treatment of uncertainty in deep models. The first issue is addressed by network compression methods (e.g. pruning and quantization), and the latter issue is tackled by Bayesian deep learning methods (e.g. variational inference, dropout). From an information-theoretic point of view, uncertainty plays a crucial role in compression - an insight which is hardly addressed in current network compression methods. Uncertainty and compression form the basis of my work on information-theoretic optimality principles for inference and decision-making under computational limitations, leading to the formation of natural **hierarchies of abstraction** and optimal **perception-action coupling**. In my PhD, I also investigated structure learning and model selection in human sensorimotor learning with virtual reality experiments.
Find more about my research on inversetemperature.net/research.

Key topics

Abstractions

Emergence of abstractions as a consequence of limited computational capacity [1]. Related to (human sensorimotor) structure learning [2].

Hierarchies

[1] Information-theoretic optimality principles for the emergence of hierarchies of abstraction and optimal perception-action coupling.

Bayesian Deep Learning

Enables (posterior) inference, marginalization and proper uncertainty-/confidence-measures for deep neural networks.

Affiliations

Bosch Center for Artificial Intelligence

Researcher, Deep Learning group **since 02/2017**

Joined newly established center.
Topics: Uncertainty in deep learning, network compression, deep learning for vision

Bosch corporate research

Researcher, Cognitive Systems group **07/2016-01/2017**

Joined Deep Learning team.
Topics: network compression, deep learning for vision

Max Planck Institute for Intelligent Systems, Tübingen

Phd candidate, computational neuroscience **01/2012-06/2016**

Co-affiliation with Max Planck Institute for Biological Cybernetics, Tübingen
Sensorimotor learning and decision-making group (Daniel A. Braun)
Topic: Structure Learning with Hierarchical Models for Computational Motor Control

Skills

areas	practical	languages
Machine learning	Probabilistic inference	Python (keras, tf/theano)
Information theory	Hierarchical Bayesian modeling	Julia
Deep learning	Neural Network compression	Matlab
Sensorimotor learning	Computer vision	C#
Robotics	Embedded systems	C/C++

SELECTED PUBLICATIONS

[1] Genewein, Leibfried, Grau-Moya, Braun (2015) *Bounded rationality, abstraction and hierarchical decision-making: an information-theoretic optimality principle*. Frontiers in Robotics and AI
[2] Genewein, Hez, Razzaghpanah, Braun (2015) *Structure Learning in Bayesian Sensorimotor Integration*. PLoS Computational Biology
[3] Genewein, Braun (2104) *Occam's Razor in sensorimotor learning*. Proceedings of the Royal Society B
[4] Grau-Moya, Leibfried, Genewein, Braun (2016) *Planning with Information-Processing Constraints and Model Uncertainty in Markov Decision Processes*. European Conference on Machine Learning (ECML)
[5] Metzen, Genewein, Fischer, Bischoff (2017) *On Detecting Adversarial Perturbations*. International Conference on Learning Representations (ICLR)
For a complete list (including posters and talks) see inversetemperature.net/publications

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Education

PhD: Computational Neuroscience

Max Planck Institute for Intelligent Systems
Max Planck Institute for Biological Cybernetics **2012-2017**

Topic: Structure Learning with Hierarchical Models for Computational Motor Control
Supervisor: Daniel A. Braun
Grade: summa cum laude

MSc, BSc: Telematics

Graz University of Technology, graduated with distinction **2006-2012**

Focus on: Computational Intelligence and Autonomous Robots.
MSc Thesis: Structure learning for robotic motor control (supervised by: Wolfgang Maass, Gerhard Neuman)

Experience

NTE Systems

Software developer (part-time) **11/2009-03/2011**

Encapsulation of ZigBee-to-web communication for a smart home automation controller
Web-service implementation on micro-controller platform (SOAP, .NET Micro Framework)

IVM Engineering

Junior consultant, software developer (part-time) **08/2008-10/2009**

Encapsulation of CAN-bus communication module (high-level backend in .NET)
Applicability of aspect-oriented programming in a commercial software project