

# Bio-inspired Vision Systems

Simone Frintrop

Published online: 8 January 2015  
© Springer-Verlag Berlin Heidelberg 2014

Dear readers,

Biologically inspired vision systems—this has been the focus of my research and my special interest since I started working on my PhD 13 years ago. I believe that there is such an elegance and power in the mechanisms that the human brain developed to deal with all the real world problems it is continuously confronted with, that it is worth to investigate these concepts deeply and to exploit them for technical systems. Especially for many vision tasks, the human visual system still outperforms machine vision systems clearly. Examples are finding arbitrary objects in images or learning the relevant properties of objects and object classes from few examples.

Therefore, it is a particular pleasure for me to be liaison editor (Pate) for this special issue. The guest editors Michael Zillich and Norbert Krüger have done a great job in creating an issue that covers a broad range of topics and offers an insight into the highly interdisciplinary and fascinating field of biologically-inspired vision systems.

Accompanying the creation of this issue was also my last contribution as a member of the editorial board of this journal and I want to say goodbye and thank hereby especially the other members of this team. Working with you was always constructive and always a pleasure! I learned a lot about the inner process of running a journal, about what it means to provide a balanced collection of topics, and to select members for the editorial board that actively participate and keep the journal alive. Every member of the board could (and should) contribute with

ideas how to shape the journal. Which topics actually belong to AI? Where is the field going? Which special issues should we plan to guarantee a balanced coverage and which guest editors would fit for these topics? Do we actually want to be a journal, or rather a magazine? Is our target audience German or International? Every member of the board has different opinions about these topics, but decisions were always made in a democratic way.

The reasons for leaving the editorial board after 4 years have nothing to do with the board or the journal itself. It was just a pragmatic decision to balance my personal work load. Everybody knows how the amount of things you are involved in continuously grows over time, ranging from acquiring new projects up to teaching and reviewing. There are so many things which are interesting and fun that it is sometimes necessary to skip some to be able to focus on others.

Talking about fun, it is a great pleasure for me to introduce this special issue, I hope you enjoy it!

Simone Frintrop

## Forthcoming Special Issues

### 1 Health and Wellbeing

Health and Wellbeing: Our ageing population—what role will you play?

The EU28 population's annual healthcare expenditure has risen to € 1,085 billion, a substantial share of which arises through secondary prevention, long-term care and home-care (€ 90 billion). These costs are increasing towards 2020, while the available budget and the number of caretakers are shrinking. In developed countries around the world, an ageing population is the new reality. It's a reality that poses challenges to society, but also unique

---

S. Frintrop (✉)  
Rheinische Friedrich-Wilhelms Universität Bonn,  
Bonn, Germany  
e-mail: frintrop@iai.uni-bonn.de

opportunities for artificial intelligence methods in health and wellbeing.

We should act on this challenge by offering AI-based solutions that respond to the demands for: (1) self-monitoring (quantified-self) related to health and habits, while these solutions will also reduce the costly demand for secondary prevention, cure and care for caretakers and insurers; (2) big health data analysis and clinical data intelligence for individualized treatment.

Themes of interest include, but are not limited to, the following areas of the patient/user centric view, the doctor/clinical view, or the combination of these two views.

Patient/user centric view:

Smart unobtrusive sensing of vital body signals (of care home residents)  
 Event/task extraction from (video) life logging  
 Data mining of contextual data  
 Personalised associations between health and behaviour  
 Vital signs and context data fusion and correlation  
 Smart coaching algorithms (life-coaching) for wellbeing  
 Intelligent User Interfaces for health and wellbeing  
 Adaptive persuasion (based on a feedback loop) and persuasion technologies  
 Adaptable interfaces that understand the physical and cognitive abilities of the user  
 Adaptive interfaces that learn so that the user becomes more comfortable with the service over time  
 Personalised schemes for behavioural change  
 Health risk assessment for individuals and specific target groups  
 Agents and healthcare  
 Embodied conversational agents (ECAs) in healthcare.

Doctor/clinical view:

Smart (unobtrusive) sensing of vital body signals in clinical environments  
 Data mining of contextual clinical data in different modalities (e.g., clinical records and medical images)  
 Semantic annotation of medical texts and images related to the ageing population  
 Text mining in the health and wellbeing domain  
 Big data analysis and clinical data intelligence  
 Personalised schemes for individualized treatment and medication  
 Formalising clinical guidelines for health and wellbeing  
 Contributions can be from the following categories (for more detailed information please refer to the author instructions for each of these categories): technical contributions, research projects, discussions, and book reviews.

If you intend to publish a paper, please contact the editors:

Jean H.A. Gelissen

Action Line Leader Health and Wellbeing EIT ICT Labs  
 High Tech Campus 69, 1C5656AG Eindhoven, The Netherlands

Phone: +31638277265

jean.gelissen@eitictlabs.eu

Dr. Daniel Sonntag

German Research Center for Artificial Intelligence

Stuhlsatzenhausweg 3D-66123 Saarbruecken, Germany

Phone: +49 681857755254

sonntag@dfki.de

We look forward to receiving your contribution!

## 2 Higher-Level Cognition and Computation

Human higher-level cognition is a multi-faceted and complex area of thinking which includes the mental processes of reasoning, decision making, creativity, and learning among others. Logic, understood as a normative theory of thinking, has a widespread and pervasive effect on the foundations of cognitive science. However, human reasoning cannot be completely described by logical systems. Sources of explanations are incomplete knowledge, incorrect beliefs, or inconsistencies. Still, humans have an impressive ability to derive satisficing, acceptable conclusions. Generally, people employ both inductive and deductive reasoning to arrive at beliefs; but the same argument that is inductively strong or powerful may be deductively invalid. Therefore, a wide range of reasoning mechanism has to be considered, such as analogical or defeasible reasoning.

The topics of interest include, but are not limited to:

- Analogical reasoning
- Common sense and defeasible reasoning
- Deductive calculi for higher-level cognition
- Inductive reasoning and cognition
- Preferred mental models and their formalization
- Probabilistic approaches of reasoning

The *Künstliche Intelligenz* journal, which is published and indexed by Springer, supports the following lists of formats: technical contributions, research projects, discussions, dissertation abstracts, conference reports and book reviews. If you are interested in contributing to this special issue, please contact one of the guest editors:

Dr. Marco Ragni

University of Freiburg

Center for Cognitive Science

Institute of Computer Science and Social Research

Friedrichstr. 50

D-79098 Freiburg, Germany

ragni@ cognition.uni-freiburg.de  
<http://portal.uni-freiburg.de/cognition/members/ragni>  
 Prof. Frieder Stolzenburg  
 Harz University of Applied Sciences  
 Automation & Computer Sciences Dep.  
 Friedrichstr. 57-59  
 38855 Wernigerode, Germany  
 fstolzenburg@hs-harz.de  
 fstolzenburg.hs-harz.de  
 Important dates:

- Statement of interest: 15-Aug-2014
- Submission deadline: 07-Oct-2014
- Notification: 15-Nov-2014
- Camera-ready copy: 15-Jan-2015
- Special issue: KI 3/2015

Submission and contribution format:

The articles should be written in english, in order to attract an international audience, formatted with the Springer LaTeX package for journals (<<http://www.static.springer.com/sgw/documents/468198/application/zip/LaTeX.zip>>).

Submissions should be sent as pdf file to [fstolzenburg@hs-harz.de](mailto:fstolzenburg@hs-harz.de).

### 3 Advances in Autonomous Learning

Autonomous Learning research aims at understanding how adaptive systems can efficiently learn from the interaction with the environment, especially by having an integrated approach to decision making and learning, allowing systems to decide by themselves on actions, representations, hyper-parameters and model structures for the purpose of efficient learning.

It addresses challenges such as how to autonomously learn representations for efficient model use, how to arrive at suitable cost functions from meta-objectives (generalizing inverse RL), how to autonomously choose model structures and hyper-parameters in possibly non-stationary environments, or how to design efficient actor-reward strategies which generalize across tasks.

Application scenarios which require these type of complex models span high-impact domains such as robotics, life-long learning, intelligent tutoring, or big data analytics.

We invite contributions related to the following non-exhaustive list of topics:

- autonomous learning of rich data representations,
- active learning in structured (e.g., hybrid, relational) interactive domains,
- learning models with autonomous complexity adaptation,
- transfer learning,
- structure learning,

- statistical relational learning,
- theoretical advances to measure model autonomy,
- applications and project reports in the field of autonomous learning.

Prof. Barbara Hammer  
 Universität Bielefeld  
 D-33594 Bielefeld  
 Prof. Marc Toussaint  
 Universität Stuttgart  
 D-70569 Stuttgart

### 4 Companion Technologies

At present, we observe a rapid growth in the development of increasingly complex “intelligent” systems that serve users throughout all areas of their daily life. They range from classical technical systems such as household devices, cars, or consumer electronics through mobile apps and services to advanced service robots in various fields of application. While many of the rather conventional systems already provide multiple modalities to interact with, the most advanced are even equipped with cognitive abilities such as perception, cognition, and reasoning. However, the use of such complex technical systems and in particular the actual exploitation of their rich functionality remain challenging and quite often lead to users’ cognitive overload and frustration.

Companion Technologies aim at bridging the gap between the extensive functionality of technical systems and human users’ individual requirements and needs. They enable the construction of really smart—adaptive, flexible, and cooperative—technical systems by employing a combination of AI techniques and relying on psychological and neurobiological findings.

The special issue “Companion Technologies” of the KI Journal aims to present ongoing research, application perspectives, and other insights into an exciting research area emerging across the fields of Artificial Intelligence, Cognitive Psychology, and Cognitive Sciences.

Topics of interest include, but are not limited to:

- Computational models of cognitive processes
- Reasoning for adaptive systems
- User-centered planning
- Multi-modal emotion and motivation recognition
- Knowledge-based human–computer interaction
- Knowledge-based dialogue management
- Cooperative and adaptive systems

The KI Journal, published and indexed by Springer, supports a variety of formats including technical articles, project descriptions, surveys, dissertation abstracts, conference reports, and book reviews.

Interested authors are asked to contact the guest editors  
at their earliest convenience:

Prof. Dr. Susanne Biundo-Stephan  
Institute of Artificial Intelligence  
Ulm University  
89069 Ulm  
susanne.biundo@uni-ulm.de  
Daniel Höller  
Institute of Artificial Intelligence

Ulm University  
89069 Ulm  
daniel.hoeller@uni-ulm.de  
Pascal Bercher  
Institute of Artificial Intelligence  
Ulm University  
89069 Ulm  
pascal.bercher@uni-ulm.de