BRAIN (INSPIRED) COMPUTING

DONDERS INSTITUTE

Introduction

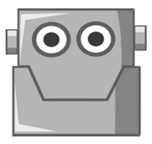
Our group studies conceptual and computational aspects of information processing in the human brain as well as in hardware systems inspired by the brain's architecture. This work is done in two major research lines: "Predictive Processing" and "Neuromorphic computing". In the first research line we study fundamental properties of the Predictive Processing accounts in (cognitive) neuroscience. We are particularly interested in the mechanisms, algorithms, and information structures needed to 'implement' higher cognition within the Predictive Processing account; how these algorithms can be tractable relative to the brain's resources and environmental constraints, and how these information structures are developed. In the second research line we are interested in novel ways of information storage and processing on new hardware architectures inspired by the brain. We aim to design energy-efficient algorithms for neuromorphic hardware and investigate which problems are inherently 'energy-hard' on such architectures. We employ a diverse array of scientific methodologies, including formal mathematical proofs in complexity theory, behavioral developmental research, conceptual analysis, computational modeling, algorithm design and analysis, and explorative developmental robotics.

Legend

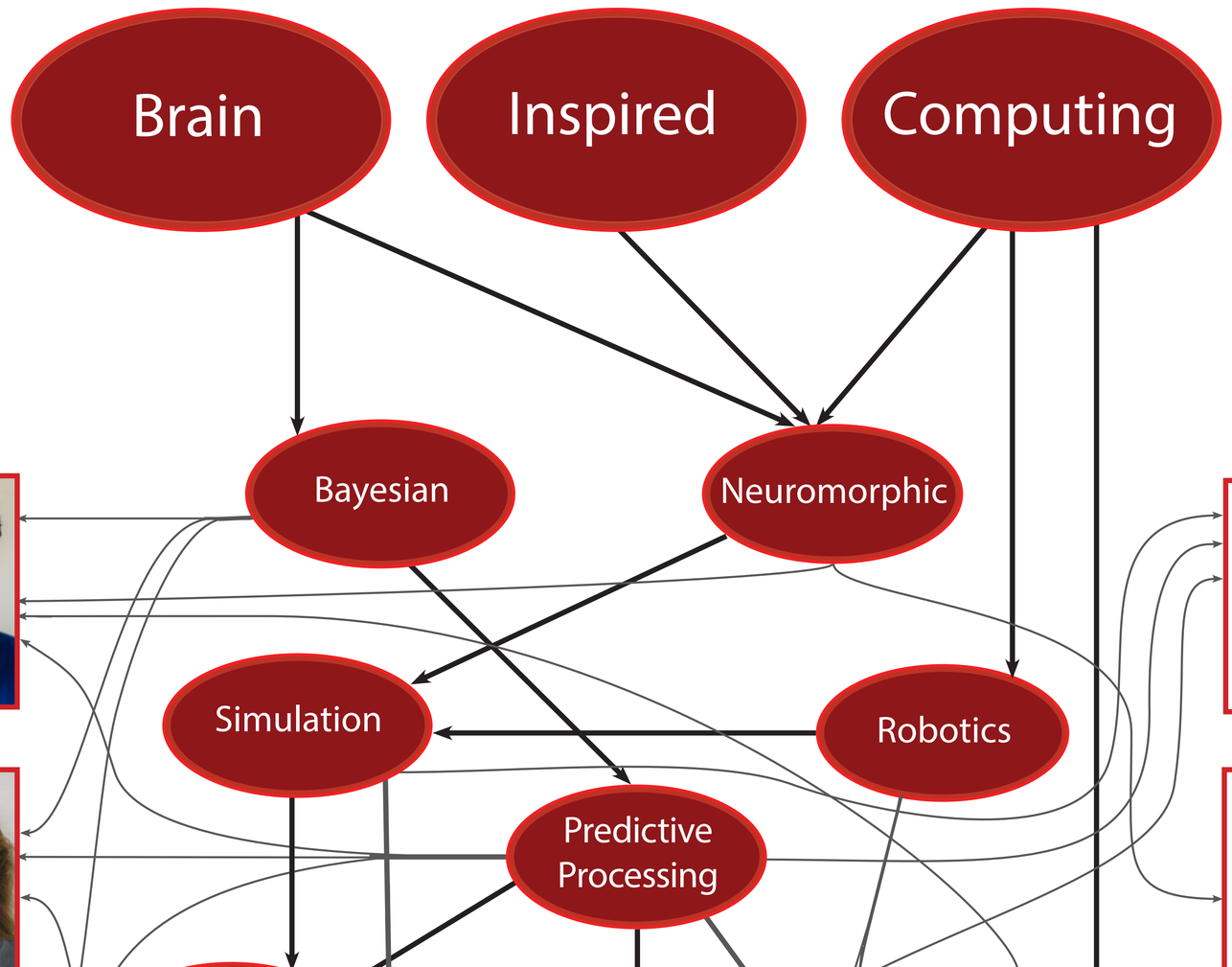
Σ Mathematical & Computational Modeling


Experimental Developmental Research


Conceptual Analysis


Explorative (Developmental) Robotics


Neuromorphic Algorithm Design & Analysis



Johan

"Understanding and mimicking the brain's efficiency in information processing."

Nils

"Unraveling the brain's complexity through computational analysis." Σ

Erwin

"Formalizing the Development of Cognition."  Σ 

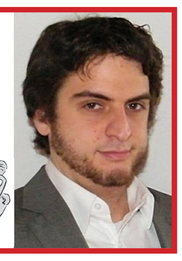
Danaja

"Learning mechanisms in development of the generative models." 

Abdullahi

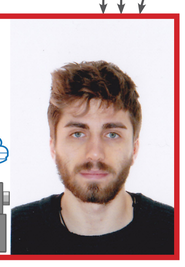
"Designing energy-efficient neural algorithms. " 

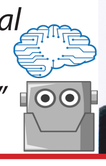
George



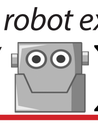
"Understanding psychedelics in predictive processing terms." 

Samuele



"Interpreting and classifying neural signals to drive robotic devices." 

Tim

"Learning actions and their consequences in explorative robot experiments."  Σ

Wouter

"Bringing infants' motor learning to robotics."  Σ

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