The NIM model as a brain for a humanoid robot

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In the context of the PACO+ project (http://www.paco-plus.org/), we propose to implement the recently developed Natural Input Memory (NIM) model [2] as a brain for a humanoid robot that operates directly on real-world visual input. The NIM model is a memory model that encompasses a perceptual front-end that takes local samples (i.e., eye fixations) from natural digitized images and translates these into memory representations. The selection of samples is guided by bottom-up processes that rely on image features and by top-down processes that rely on previously stored memory representations [3]. Each sample is translated into a feature-vector representation using a biologically informed method that involves a multi-scale wavelet decomposition followed by a principal component analysis. This is an often applied method in the domain of visual object recognition to model the first stages of processing of information in the human visual system (i.e., retinaLGN, V1/V2, V4/LOC; [4]). The representations are used to make memory-based decisions such as recognition and classification decisions and also to direct gaze towards relevant spatial locations. Traditional computational memory models (e.g., the REM model, [6]) lack such a perceptual front-end and focus on the isolated mechanisms underlying memory processes without taking the environmental context into consideration. These models fall short as models of cognitive natural systems, which are known to relie on the interaction with the environment for learning and survival (e.g., [1, 5]). The NIM model provides a connection between memory models and the real world. Implementing the NIM model into a humanoid robot provides a first step toward solving the extremely challenging task of developing a cognitive system that can perceive and interact with its environment.

References

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