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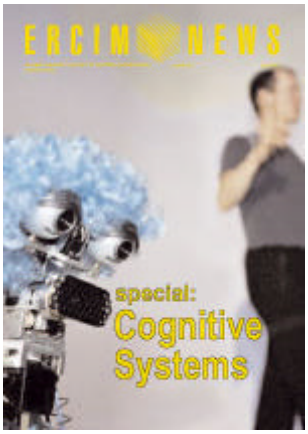

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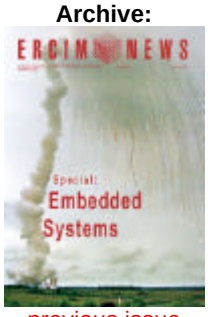

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About ERCIM News

Understanding and Interpreting the Activities of Expe a Cognitive Vision Methodology

by Stelios Orphanoudakis, Antonis Argyros and Markus Vincze

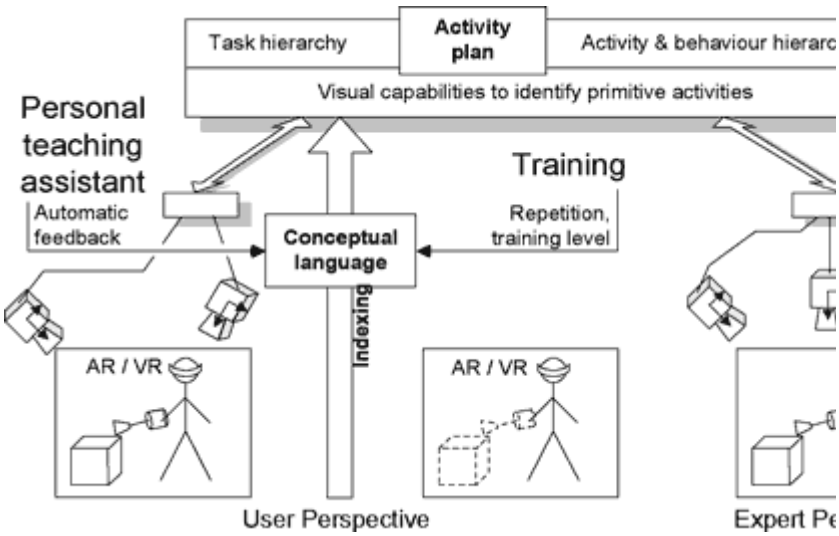
The ActIPret project, funded by the European IST programme, aims to build adv systems, able to recognize and interpret the activities of experts in the context c framework.

One of the fundamental abilities possessed by humans is that of acquiring skills throug Teaching by demonstration is consequently a powerful way to provide training. Despit of teaching is not always possible because of distance and time barriers; experts can groups of trainees, at a certain location and for a limited time period. These barriers co could realise a computational vision system that is capable of understanding, interpret indexing the activities of experts. The combination of such a system with recent advan virtual and augmented reality (VR/AR) could be used to effectively search, retrieve an reproduce the activities of experts anywhere and anytime.

Humans have a remarkable ability to visually interpret the activities of other humans, t interpretations into knowledge and subsequently exploit this knowledge in acquiring re by demonstration therefore constitutes a powerful training technique. Currently, teachi entails an expert demonstrating her/his expertise to small groups of trainees on specif occasions. Time and distance barriers hinder the observation of experts in action. Rec activities on video provides a partial solution to this problem and allows repeated view other important limitations. Although video records a dynamic sequence of events, in s 'static' source of information. The fixed viewpoint restricts visibility and may lead to am Moreover, activities cannot be indexed and effectively searched, as is the case with in a manual or user's guide.

With recent developments in virtual and augmented reality (VR/AR), it is now possible quality representations of a reconstructed scene and a realistic replay of activities ther could prove invaluable in developing tools for teaching by observation, provided that th interpretation of the activities of an expert is also possible. The coupling of these capa the removal of most of the important barriers in teaching through observation. The exp can be replayed anywhere, anytime and from any viewpoint. Moreover, the activities c efficiently and effectively, and retrieved by the trainee based on her/his needs.

The overall objective of ActIPret is to develop a cognitive vision methodology that perr interpretation of the activities of people handling tools. Interpreted activities can be sto that can be referenced later by the user. The activity plan is an indexed manual in the reconstructed scenes, which can be replayed at any time and location to many users u equipment. Research and development is focused on the active observation and inter activities, on the extraction of the essential activities and their functional dependence, them into constituent behaviour elements. The approach is active in the sense that the obtain views that facilitate the interpretation of the observed activities. Moreover, task is exploited as a means of constraining interpretation. Robust perception and interpret key to capturing the essential information, allowing the reproduction of task sequences understand representations and providing a user-friendly tool for the trainee.



Using the ActIPret system to record and retrieve activities.

The figure illustrates the envisioned scenarios of use of the ActIPret system. During re activities are observed and an activity plan is obtained. During replay, the trainee/user activities of interest using a conceptual language. The user is then able to choose betv replay of the sequence from arbitrary viewpoints, depending on the training level or (2 system in the form of a personal teaching assistant. In this case, for a selected task, th by the user are automatically compared with the activities of the expert and improvem This results in more effective training, compared to repetition without feedback.

ActIPret has two main technical objectives: the design and evaluation of a cognitive vi extracts and interprets activities, and the development of purposive visual processing techniques to provide the required perceptual capabilities.

To achieve a robust interpretation of activities, the interaction of visual attention, active recognition, understanding, and knowledge from models, tasks, and context are being interaction of these modules is the essential mechanism for removing possible ambigu inherently uncertain information obtained through visual processing. The cognitive visi possible to discriminate between activities that are essential to the task at hand (and s maintained) and those that are irrelevant (and should therefore be eliminated from the The final outcome of the cognitive approach is the activity plan, which contains an inde behaviours for access in user-driven training and for feedback while the trainee is rehe

To achieve the cognitive ability of the framework, vision techniques must provide the r the form of self-contained, cooperating components. The framework consists of both t /behaviour-/context-driven) and bottom-up (data-driven, self-evaluating) interacting co four types of visual processing components:

- extraction of cues and features
- detection of context-dependent relationships between cues/features
- recognition of activities and objects handled, taking into account potential occlu
- synthesis of behaviours and tasks that modify the context of the other compon

All four types of components report visual evidence with confidence measures. These interpretation are interlaced with the attentive and investigative behaviours that provid purposively focus processing. Robust interpretation results are achieved with methods desirable viewpoints and obtain elucidative information for detection, recognition and s is also enhanced using context-dependent information integration between the compo The ActIPret consortium consists of the following partners: Institute of Automation and University of Technology (Project Coordinator), Center for Machine Perception at the C University, School of Cognitive and Computing Sciences at the University of Sussex, U Vision and Robotics Laboratory, ICS-FORTH and PROFACTOR - Produktionsforschu

Link:
Project web site: http://actipret.infa.tuwien.ac.at/

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