A Component-based Approach to Activity Interpretation

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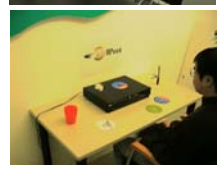
http://actipret.acin.tuwien.ac.at

Vision for Interaction

ActIPret: interpreting activities of humans while they handle objects



System Capabilities

- Robust detection, tracking, recognition, interpretation
- Spatio-temporal object reasoning (in 3D)
- Semantic interpretation

Goal of Demonstration (1/2)

- Demonstrate layered *Cognitive Vision* approach
- Study the interaction of high-level and low-level information
  - Task knowledge drives the selection of visual capabilities
  - Contextual knowledge limits scope of interpretation
  - Task-based control of SOI (Space of Interest)
  - Visual functions are dynamically triggered
- Interpretation of scenario „Place CD in CD-player“
- Learn interpretation for a large number of persons

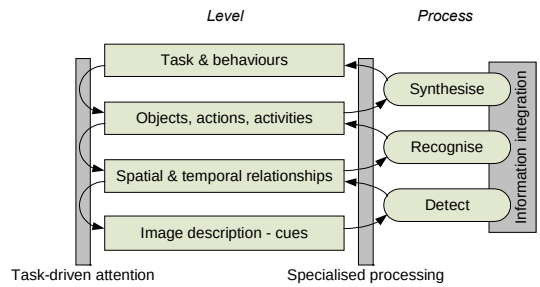
Goal of Demonstration (2/2)

- Cope with varying activity sequences
- Demonstrate the software framework zwork
- Demonstrate a system running 12 components
  - Image services (stereo, camera pose, timing),
  - Hand and object tracking,
  - Object and gesture recognition, shape detection,
  - Relationship analysis, activity reasoning

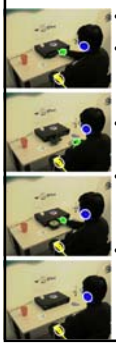
Personal Teach Assistant - Applications

- User guidance to operate a machine (e.g., copy machine, video/CD-player)
- User guidance to assembly objects (e.g., furniture, machine maintenance)
- Exploit Augmented Reality to display information
- Use on-line interpretation to give hints and suggest corrections to user

Cognitive Vision System Approach

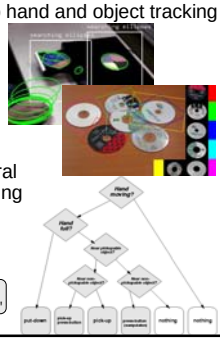


Cognitive Vision Components



- Robust stereo hand and object tracking
- Robust object detection and recognition
- Hand gesture recognition
- Spatio-temporal object reasoning (in 3D)
- Semantic interpretation:

`'Hand 0 picked up object cd-linux-0'`

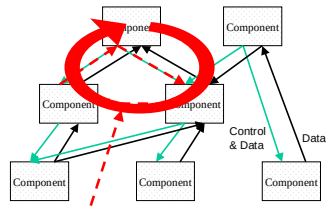


Pro-active System Control

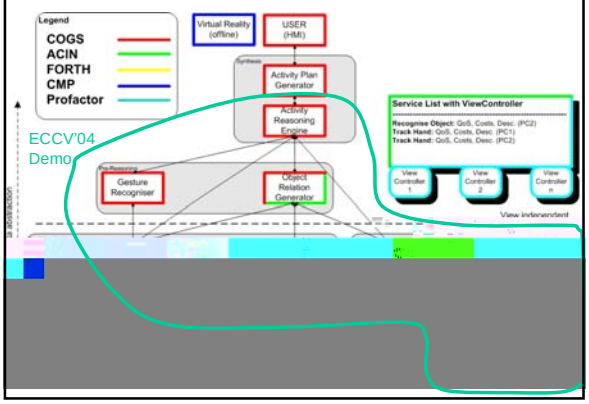
Pro-activity:

- Goal and task orientation
- Take the initiative
- Generate subtasks

[after Mike Wooldridge]

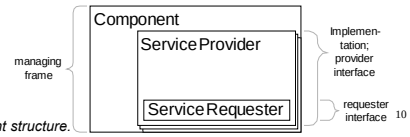


No communication in one layer
⇒ Avoiding deadlocks



Zwork (Zillich's network)

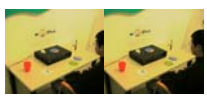
- Lightweight
- RPC (Remote Procedure Calls)
- Asynchronous
- Automatic marshalling of messages
- Simple debugging (gdb/ddd)
- Logging
- GUI

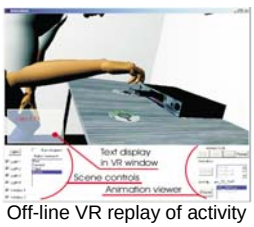


Component structure.

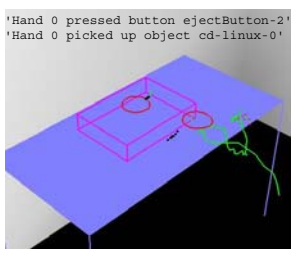
GUI – Graphical User Interface

Stereo observation





Off-line VR replay of activity



On-line display of 3D results (trajectories, recognition and interpretation results,)

Summary

- The system is *more* than the sum of its components
- Generic approach to activity interpretation
- Success rates per component and system using annotated video database for evaluation

	Components				System	
2004	HTTest_FORTH HT_FORTH IS_Profactor CDS_Profactor	ORTest_CMP OR_CMP IS_Profactor CDS_Profactor	GRTest_COGS GR_COGS HT_FORTH IS_Profactor CDS_Profactor	ORGTest_ACIN ORG_ACIN ODT_ACIN_V4R FD_Ellipse_ACIN OR_CMP IS_Profactor CDS_Profactor	All 12 components	Framework stability
Week 2		96%	100%	98%	20%	-
Week 3	100%	96%	100%	99%	34%	-
Week 4	100%	98%	100%	-	36%	100%
Week 12	-	-	-	-	68%	100%
Week 14	-	-	-	-	82%	100%