

Records and Memory of Experiences by Interaction Media

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The combination of human memory and computer records through various interaction media can construct a computer-augmented artificial memory. Memorizing is a unique human intelligent activity. Its uniqueness can be characterized by selective memory, abstraction, association, emotion, and so on. It also has some negative characteristics of memory error such as forgetting, absent-mindedness, and blocking. People have developed and used various media to overcome these problems such as the pen and paper, photography, and the video recorder. As computers acquire a huge amount of memory capacity in ubiquitous computing environments, computational media will be used as our external memory in the near future to support everyday human memorizing activities.

This research focuses on developing new tools and interfaces for the non-cumbersome recording of experiences, novel editing methods to abstract and summarize them, and communication media for sharing experiences. Beginning with the development of devices such as a wearable interaction recording system and a toy-doll shaped life-time artificial partner, we will uncover the key issues for aiding human memory and a way to solve the problem issues. The research includes the analysis of human behavior to anticipate the future series of actions by referring to behavior prototypes. Developing a large scale interaction corpus through ubiquitous computing technology is the very first step.

In this first step, we propose to build an interaction corpus, that is a semi-structured set of a large amount of interaction data collected by various sensors. The sensors include video cameras, microphones, and physiological sensors to monitor humans as the subjects of the interactions. More importantly, ID tags with an infrared LED and infrared signal tracking device are incorporated in order to record the positional context along with the audio/video data. We aim to use this corpus as media to share past experiences with other people. Since the captured data is segmented into primitive behaviors and annotated semantically, it is easy to collect highlighted actions, for example, to generate a reconstructed diary. The corpus can, of course, also serve as an infrastructure for researchers to analyze and model social protocols of human interactions.

The research should also cover the interface design issues of such devices because particular memorizing activity can be assisted by an association with embodied objects. We will address the merit of the artificial partners by their second-person standing position and intimate design. We are developing a toy-doll shaped artificial partner that can record its master's activities by embedded various sensors such as a video camera, microphone, touch sensors, positioning sensor, and so on. The records are indexed and annotated by automatically recognized context for further processing, such as retrieving a requested event and summarizing an experience.

A computerized memory aid is a challenging but promising research theme. Various high-density and multi-media digital recording devices have been developed and will continue to be improved. It is almost possible to record and store a whole life of video and audio data to a small magnetic disk memory. Humans are facing a catastrophic flood of information through the Internet. Is it possible for us to access only necessary and valuable information chunks? Of course, we cannot memorize entire documents and events in our brain memory system, even only indexes. The world is moving towards a senior citizen society. As human memory error increases with age, the memory aids will soon become a social issue. We are already observing the forefront of memory aids in Alzheimer's disease. Psychological issues should also not be overlooked. Psychotic depression and traumatic memory are strongly related, for instance. The derived artificial memory architecture may be able to relieve mental pain by helping the brain memory to forget a traumatic event permitting the person to face the event slowly in order to accept it.

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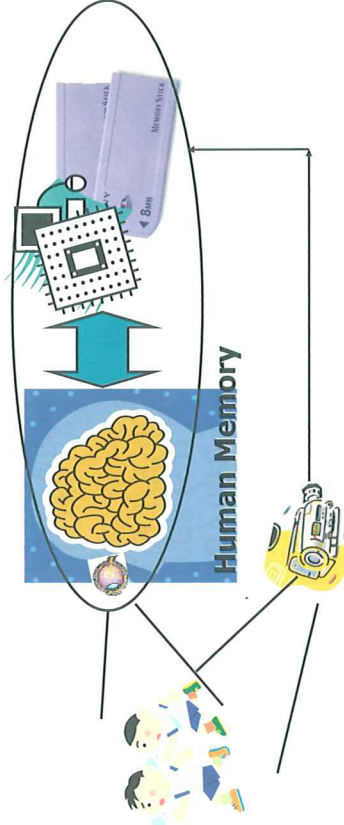
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1

Artificial Memory



2

Memory vs. Record

Memorizing is human's intelligent activity

Selective memory

Abstraction

Forget

Emotional

Recording with machine

External memory of human activity

Focus-less, as-is

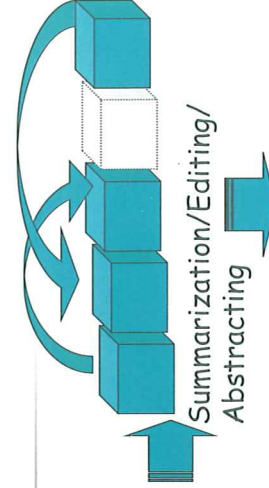


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Artificial Memory Application

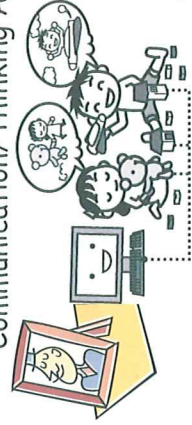


Memorizing Life-time Experiences



Summarization/Editing/Abstracting

Communication/Thinking Aid



4

Research Goals

Memory Aid
Memorize/Remember
External Memory and Retrieve/Search
Summarization/Editing of Experience
Multimedia Life-time Diary/Journal
Analysis of interaction/behavior
Computer Mediated Communication (CMC)
Computational Theory of Memorizing and Experience

Technical / Social Backgrounds

Various Digital Recording Devices
Flood of Information
Impossible to memorize whole events
Ubiquitous/Wearable Computing

Senior Citizen Society
Alzheimer's disease
Psychology and Therapy
PTSD
Psychotic Depression

Engineering Issues

Recording Device
Live Recording (1st/2nd/3rd person)
Indexing Cue (e.g. emotional queue)
Life-time Artificial Partner

Editing
Intuitive
Direct Manipulation

Ubiquitous Computing

Everyday life
Tracking people and objects
Sensor network



Wearable Computing

24hours on, Hands-free
Mobility, AR manuals
Real-time recording of
activities



Related Works

Familiar, Interaction Media (ATR)
LifeLog (DARPA)
MyLifeBits (G. Bell, MSR)
Wearables (MIT, GaTech, NAIST,
Tokyo U., Hakodate Mirai U.)

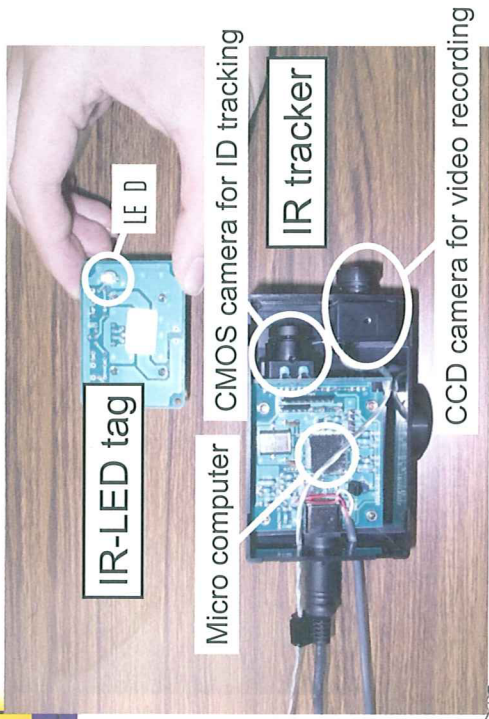
Example: Ubiquitous Interaction Media (2001 ATR)

Ubiquitous Sensor Room
Multi-user, Multi-modal, Multi-sensors (IR-ID
tracker, Video, Microphone, Biosensors)
Intelligent co-Creative Partners (Robovie, Doll)
Interaction Capture
Full automatic annotation (via IR-ID tags)
Multi-Viewpoint Observations of an Event
Every-day Life Recording

Experimental Setting of USR



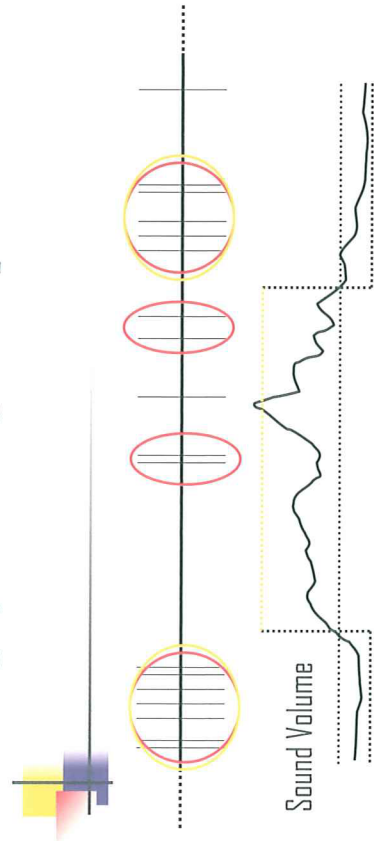
IR ID Tracker and Tag



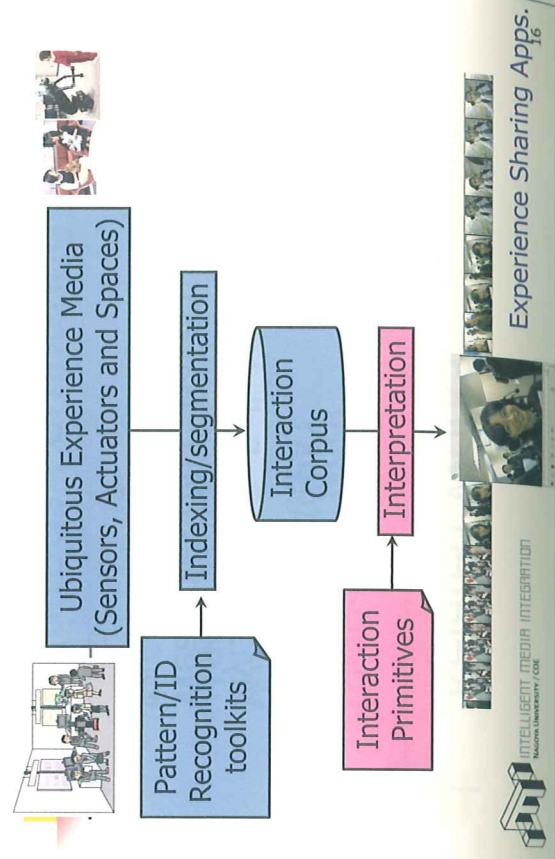
Indexing by Visual Tags

ID	TIME	Y
4	1036571603.137000	61 229
60	1036571603.448000	150 29
4	1036571603.878000	61 228
60	1036571604.319000	149 28
4	1036571604.659000	62 227
60	1036571605.440000	152 31
60	1036571605.791000	150 28
60	1036571606.131000	148 30
4	1036571606.472000	64 230
60	1036571607.163000	150 30
60	1036571608.074000	150 30
60	1036571608.385000	148 29
60	1036571608.725000	146 28
4	1036571609.066000	65 228

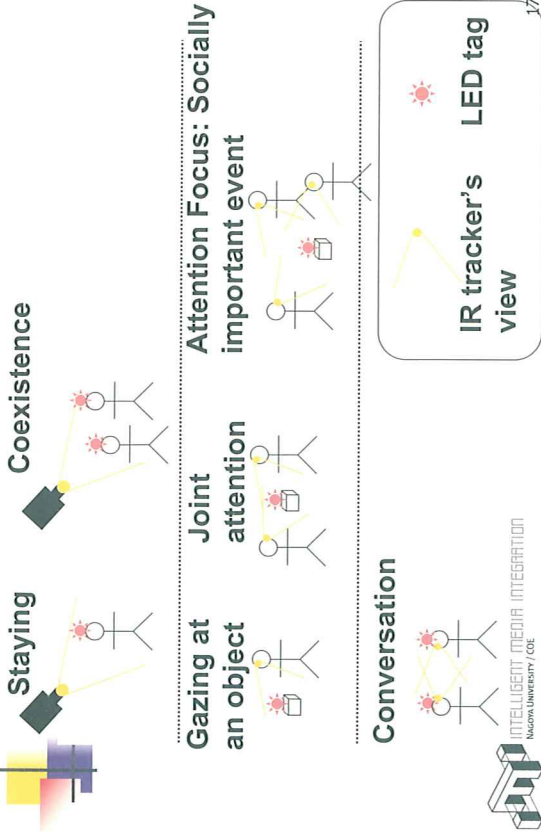
Indexing by visual tags and speech volume



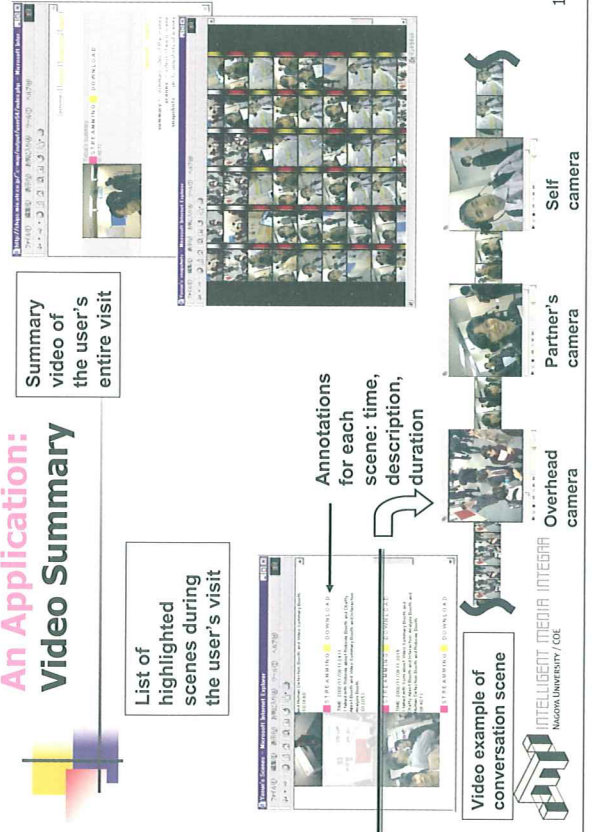
Interaction Corpus as Knowledge Bases



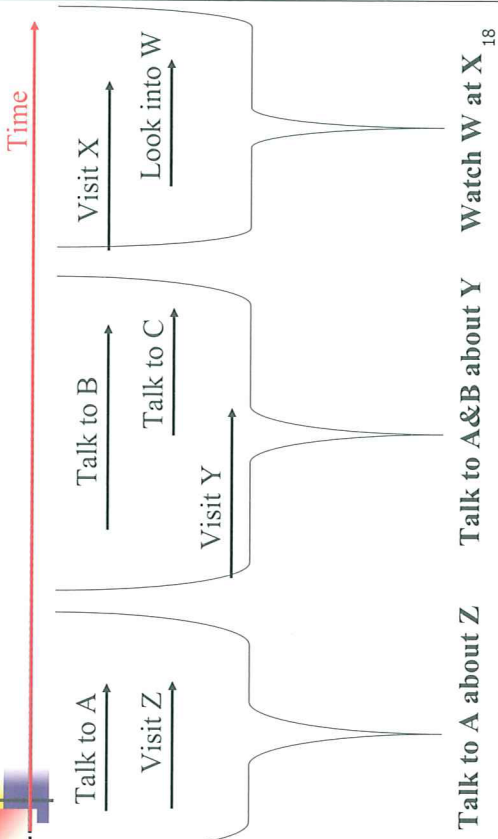
Interaction Primitives



An Application: Video Summary



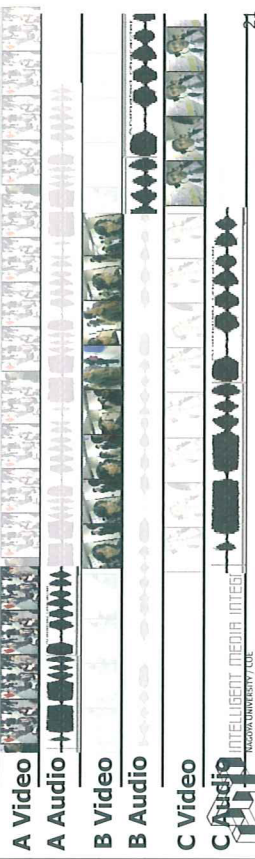
Interpreting Events to Scenes Grouping by Space-time Co-occurrence



Video Summary (example)



Integrated Video Summary (inter-using of video and audio)



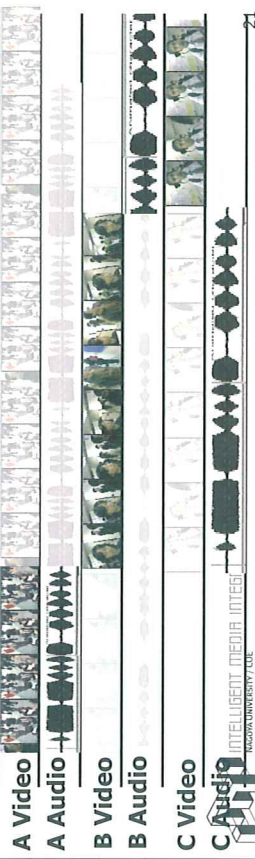
Wearables + Environment + Inbetweens = Interaction Media



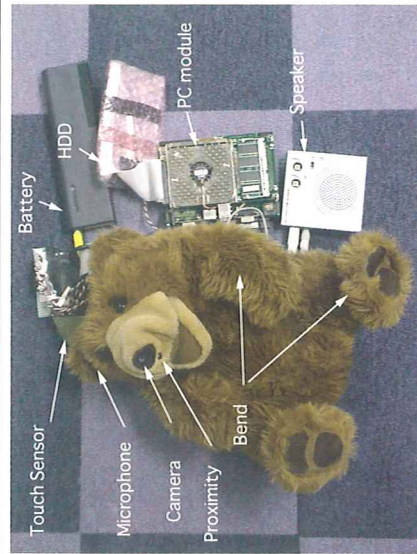
Summary

- IT for Everyday Life
- Memory Aid
- Technology
- Usable/Intimate Recording Device
- Automatic Indexing
- Summarization/Editing

Integrated Video Summary (inter-using of video and audio)



Sensor Toy Doll (2001)



Camera	1
Microphone	1
G-force sensor	1
Bend sensor	4
Touch sensor	5
Proximity sensor	2
Heat sensor	23