A General Architecture for Self-Adaptive AmI Components Applied in Speech Recognition

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• Outline
  – Application Scenario
  – Our three types of adaptation
  – Integration of speech recognition into our AmI-scenario as one type of adaptation
  – Outlook
Motivation Example – Assisted Training (1)

- Training group of (racing) cyclists
- Given track profile

- Cyclists have different qualities regarding the track sections
- Each cyclist has a given overall physical condition and an individual training plan
- Training effect depends on the speed of the group and the position of the cyclist within the group formation

Main goal of the system
- Optimization of the single training effect
- Optimization of the group training effect
Motivation Example – Assisted Training (2)
(Currently) explored adaptation variants

- **Service Implementation Adaptation**
  Self-adaptation of speech recognition service

- **Service Usage Adaptation**
  Change from a visual UI to a speech generation UI service implementation

- **Service Configuration Adaptation**
  New component containing new services plugs into the training system and results in a reconfiguration of the overall system from single bicycle to group bicycle training
• Speech Recognition in the AmI-Prototype
  – Why
    » Natural communication with the system
    » But important: High recognition rate in changing environmental conditions such as
      ▪ Different speaker (young, old, female, male)
      ▪ Background noise
      ▪ Mental and physical stress of the speaker
  – Our goal
    » Input of upper and lower pulse boundary using speech input
    » Take into account the physical stress of the user
  – Realization in cooperation with the BUTE (Budapest University of Technology and Economics)
    » Using Hungarian speech recognition engine
      ▪ Task: Mapping on German speech
    » Take into account current stress of the speaker using German speech recordings
    » Feature: Speech recognizer is runnable on „small“ devices like
      ▪ PDA, Handy, …
Speech Recognition

- Speech Signal
- Matching Algorithm
- Recognized Phrase
- Reference Model

Flowchart:
1. Speech Signal
2. Matching Algorithm
3. Recognized Phrase
4. Reference Model (feedback loop)
• Generic Approach
  – Stress Recognition
    » Current research topic
      ▪ Automatic stress detection
    » In our scenario
      ▪ Stress detection using the pulse value of the speaker
  – Compensation of stress features
    » Manipulation of speech-statistics at runtime
      ▪ High computational power required
    » Switching between different speech-statistics which have been created offline
Architecture of a Self-Adaptive Component

Pulse Sensor

Sensor Network

Self-adaptive speech recognizer

Stress recognition and stress level

Context Providing Interface

Decision of how to react on a specific stress level

Switching between statistics

Self-adaptive Aml component

Context Providing

Context Adaptation Interface

Context Adaptation

Context Processing

Actor Network
Outlook

• Service configuration adaptation
  – First version is already implemented
• Description techniques for „Quality of Service“
  – Especially required by
    » Service Usage adaptation
    » Service Configuration adaptation
  – What is the best service at the moment?
  – Criterion can change during runtime!
Any Questions?