Multi-Modal Competence Assessment Based on Users’ Performance on Complex Tasks

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Overview

• Adaptive competence assessment in CbKST
• Microadaptivity and non-invasive assessment
• Multi-modal assessment
Adaptive Competence Assessment in CbKST

• Knowledge Space Theory (KST) structures items of knowledge by prerequisite relations
• Competence based KST clearly distinguishes between abstract competences and concrete objects (test problems, lessons, …)
• Prerequisite structures serve as a basis for adaptivity
Adaptive Competence Assessment in CbKST

• Mimicking a private teacher:
  – Starting with a question of medium difficulty
  – Subsequent questions are more or less difficult, depending on the previous answers
• Non-numerical testing, i.e. testing what a person knows (vs. how much)
• A learner’s competence state is given by the subset of competences s/he masters. The set of all possible states is called competence space.
Competence Assessment in CbKST

1. False c
2. Corr. b
3. Corr. d
Adaptive Competence Assessment in CbKST

• Lerners’ responses do not always perfectly reflect their competence state
• Therefore, probabilistic assessment is applied
• Three main components:
  1. Question rule
  2. Update rule
  3. Stopping criterion
Microadaptivity and Non-Invasive Assessment

• Originating from game-based learning
• Distinguishing two types of adaptivity
  – Macro level: adapting by selecting learning objects
  – Micro level: adapting by changing a learning object during its consumption
• Non-invasive assessment in order to not disturb the flow of the game
Microadaptivity and Non-Invasive Assessment

- Connecting CbKST and problem spaces
- Interpreting users’ actions by underlying (required or missing) competences
- Updating probabilities according to such evidences
- Non-invasive assessment means also no optimal selection of questions
- Immediate related feedback
Multi-Modal Assessment

- Not everything can be tested by questions and test problems
- Assessment information should be gathered from different types of sources
- Need arose in medical competence assessment based on simulations and on work with patients
Multi-Modal Assessment

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Multi-Modal Assessment

Numerous possible types of sources:
• Questions and test problems
• Simulators, virtual reality, game situation
• Self, peer, and expert assessment
• Analysis of tasks and results in daily work

Not all sources are suited for all contexts.
Multi-Modal Assessment

- Adaptivity on a macro level, e.g.,
  - Which case scenario is used in a simulation
  - When to ask a user for a self assessment

- Adaptivity on a micro level, e.g.,
  - Introduce a difficulty in a simulation if a testee seems secure
  - Dynamic questionnaires for self/peer/expert assessment
Multi-Modal Assessment

Components of assessment procedure
• Update: Real-time requirement
• Questioning: Decreased importance, redundant assessment information occur
• Stopping criterion: Only needed in training context
Conclusions

- (Cb)KST was developed for the adaptive assessment of knowledge and competences
- The original aim was to uncover a testee’s competence state asking a minimal number of questions
- Multi-modal assessment allows transfer of non-numerical testing to much broader applications
Thank You for Your Attention!

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