

EUNITE Plenary Contribution

User-Adaptive and Other Smart Adaptive Systems: Possible Synergies



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Plenary Session and Panel Discussion
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1. When should a smart adaptive system
 - a. adapt?
 - b. stay the same?
 - c. start from scratch?
2. How can transparency be achieved?



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What Is a User-Adaptive System?

What Is Adaptivity Again?

Davide Anguita, Thursday morning:

1. Adaptation to a changing environment
2. Adaptation to a similar setting without explicitly being ported to it
3. Adaptation to a new/unknown application

Characteristic of user-adaptive systems:

4. Adaptation to an individual user's ...
 - interests, knowledge, perceptual or physical impairments, location and context, ...

Examples from eunite 2001

- *Smart Adaptive Support for Selling Computers on the Internet*
 - Tomas Kocka, Petr Berka, Tomas Kroupa
- *Content Based Analysis of Email Databases Using Self-Organizing Maps*
 - Andreas Nürnberger, Marcin Detyniecki

Deciding How Much to Adapt Formulation of Question

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General formulation

- Given a model M_A for Situation A,
 - derive an adapted model M_B for Situation B

How much adaptation?

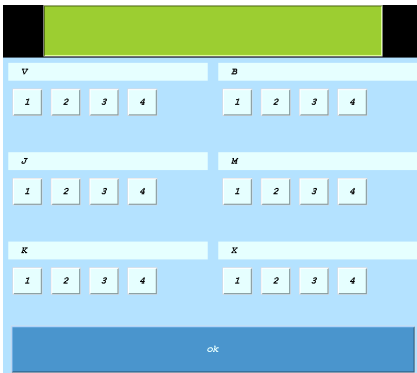
1. None at all: Use M_A for Situation B as well
2. Complete: Forget about M_A , learn from scratch in Situation B
3. Some adaptation
 - What should be the relative weights of the following?
 - Knowledge encoded in M_A
 - New data about Situation B

Articles and other resources concerning user-adaptive systems can be accessed via <http://oliki.de/~jameson>

The learning methods discussed in this section are presented in: Jameson, A., & Wittig, F. (2001). Leveraging data at users in general in the learning of individual user models. In B. Nebel (Ed.), *Proceedings of the Seventeenth International Joint Conference on Artificial Intelligence* (pp. 1185–1192). San Francisco, CA: Morgan Kaufmann. <http://w6.cs.uci-sb.de/~ready/>

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Example Domain



Stepwise:

\mathcal{S} : Set X to 3.

\mathcal{U} : ... [OK]

\mathcal{S} : Set M to 1.

\mathcal{U} : ... [OK]

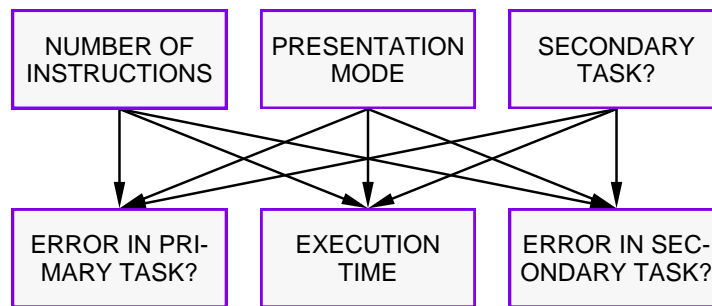
\mathcal{S} : Set V to 4.

Bundled:

\mathcal{S} : Set X to 3,

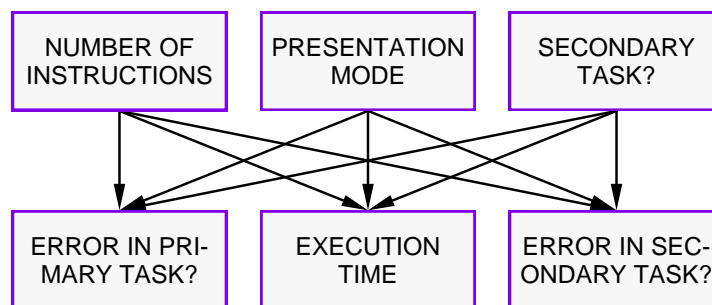
set M to 1,

set V to 4



Model and Basic Procedure

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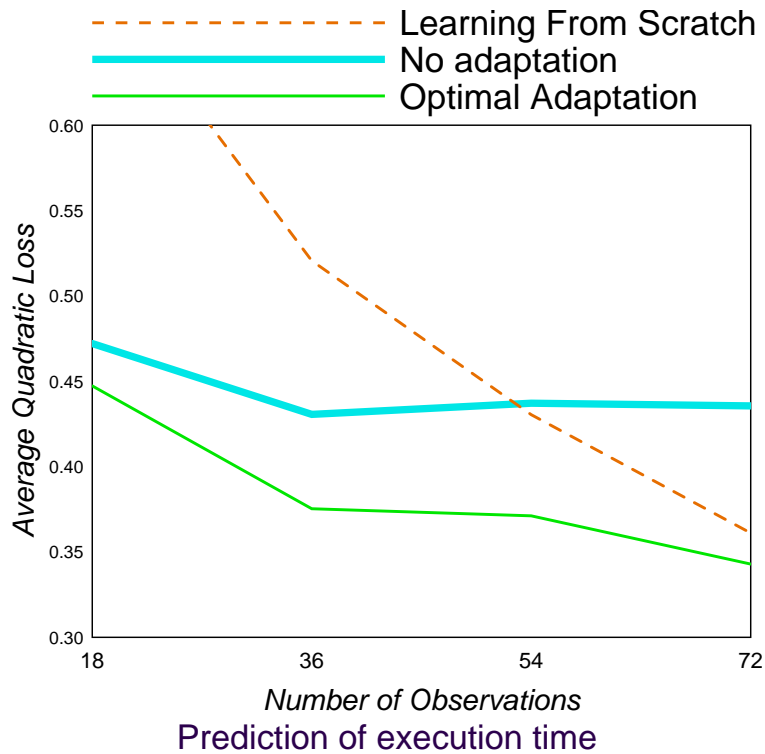


1. Learn a *general* user model with data from 31 users
2. Use this model as a starting point for the modeling of User #32
3. Adapt the model to User #32 on the basis of his/her behavior

The experiment that yielded the data shown in this section is described in Jameson, A., Großmann-Hütter, B., Marco Rummel, R., Bohnenberger, T., & Wittig, F. (2001). When actions have consequences: Empirically based decision making for intelligent user interfaces. *Knowledge-Based Systems*, 14, 75–92. <http://w5.cs.uni-sb.de/~ready/>

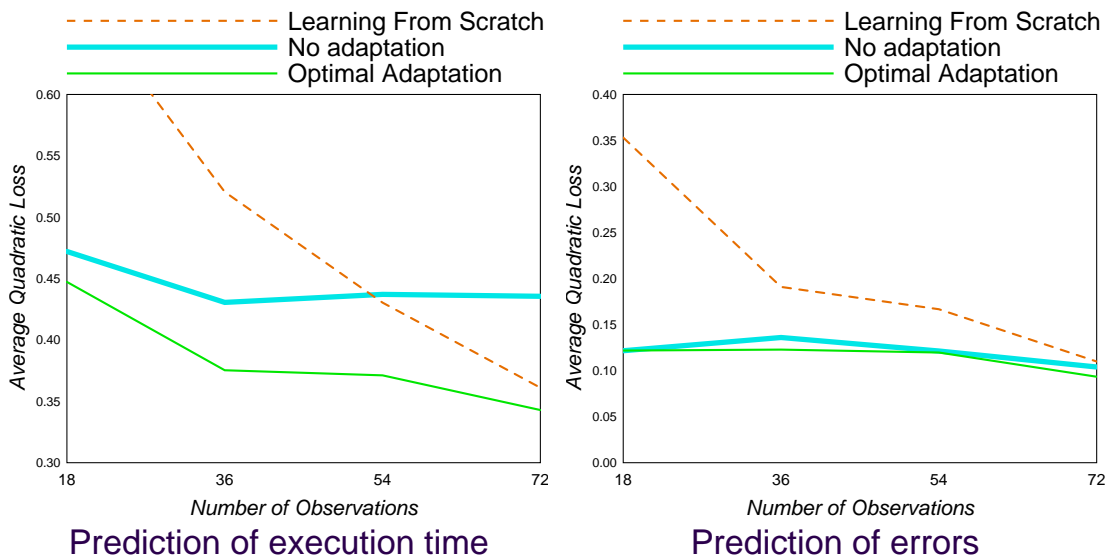
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Adaptation Can Increase Accuracy



"No Adaptation" May Be Optimal

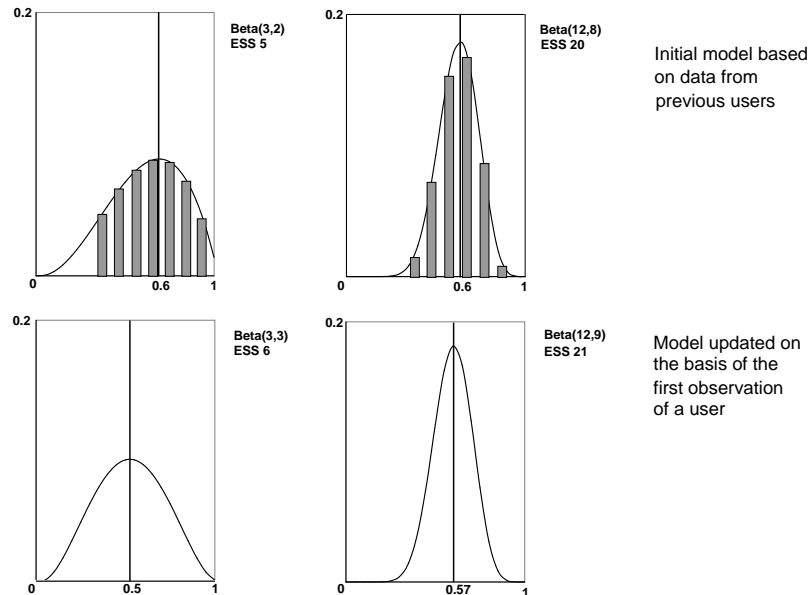
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Determining How Much to Adapt

- The system can learn, on the basis of experience with previous situations, how much each part of its model should be adapted to a new situation



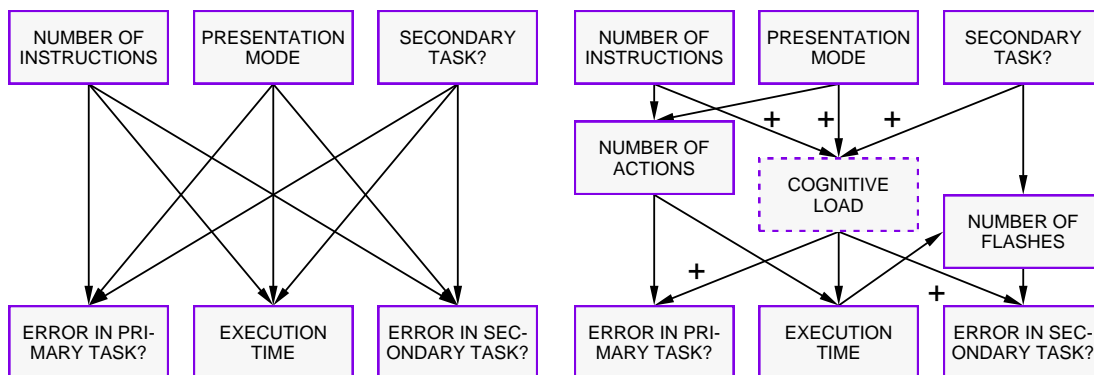
Making Adaptation Transparent Ways of Achieving Transparency

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- Modify learning process to enhance transparency of resulting models
 - EUNITE 2001 papers:
By Gabrys, by Nauck, and by R. P. Paiva & António Dourado Correia
- Choose an inherently transparent technique
 - EUNITE 2001 Competition:
First place: Ignore summer data, temperature, and holiday status
Second place: Adaptive Logic Networks
Third place: Predict on basis of day of week
- Simplify the explanation
- Use powerful visualizations

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Transparency vs. Accuracy?



- *Hidden variables* can increase interpretability of structure
- They can lead to *uninterpretable links*
- If we specify *qualitative constraints*,
 - We can ensure links are interpretable
 - And we can increase accuracy (or at least not diminish it)

Why may a more interpretable model be more accurate?

1. Simpler \Rightarrow less overfitting
2. Exploitation of prior knowledge \Rightarrow better local optimum

The method for the learning of Bayesian networks with hidden variables subject to qualitative constraints is presented in Wittig, F., & Jameson, A. (2000). Exploiting qualitative knowledge in the learning of conditional probabilities of Bayesian networks. In C. B. Jones & M. Goldszmidt (Eds.), *Uncertainty in Artificial Intelligence: Proceedings of the Sixteenth Conference* (pp. 644–652). San Francisco: Morgan Kaufmann.
<http://w5.cs.uni-sb.de/~ready/>

Simple Models and Representations

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Recognizing Time Pressure and Cognitive Load on the Basis of Speech: An Experimental Study (**Recommendation to include in Hotlist: Accept or Reject**)

Authors: Christian Müller, Barbara Großmann-Hutter, Anthony Jameson, Ralf Rummer, Frank Wittig

Time: 10:30 – 11:00 AM

Hotlist Recommender Concepts (with your estimated interest levels) [?]: Modeling psychological states (+++), Context-awareness, Machine learning (--), Decision-theoretic methods (+), Empirical studies (+)

Abstract: In an experimental environment, we simulated the situation of a user who gives speech input to a system while

Recommendation on a conference web site

Simple basic mechanism

- Naive Bayes classifier, using only 20 features

Simplified explanation

- Strength of recommendation = number of "+" minus number of "--"

Relationship

- Number of "+" or "--" reflects the log of the likelihood ratio

Issue

- When is a simplified explanation more misleading than helpful?

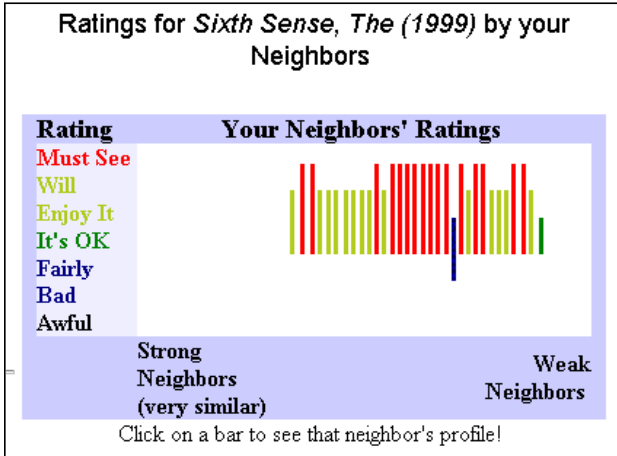
URL of the website for the conference UM 2001: <http://dfki.de/um2001>



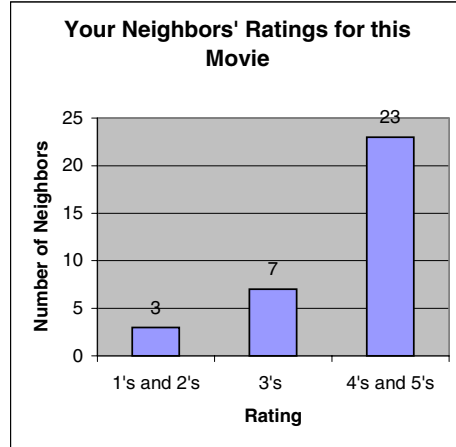
The Eye of the Beholder

Which explanation of a movie recommendation is better?

Herlocker, J. L., Konstan, J. A., & Riedl, J. J. (2000). Explaining collaborative filtering recommendations. Proceedings of the 2000 Conference on Computer-Supported Cooperative Work.



Designers' favorite



Users' favorite

Moral: Put the user in the loop!