Management of Experience Data for Rapid Adaption to New Preferences based on Bayesian Significance Evaluation

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For What?
In a teaching and learning environment Bayesian network fits well because it can adjust its structure as per data presented to it. When a Bayesian network learns with a huge number of data, its belief value is updated even if the change in belief is not significant. This causes a problem when the user’s preference changes over time. The learning process cannot catch up rapidly enough to handle a new user preference. This problem is addressed in this work.

How?
To realize such an experience management system, we propose an algorithm for discarding insignificant data. The algorithm uses a beta and Dirichlet distribution based significance test to discard insignificant data. The test is used to compare the change in confidence for consecutive time steps. When change in confidence is greater than or equal to a threshold the data is accepted otherwise data is discarded as insignificant data.

The Method
Beta distribution is used for two user preferences. Dirichlet distribution is an extension and can be used for multiple preferences.

Parameters controls the shape hence behavior of the distribution.

Peak of the distribution moves with the parameter and represent the confidence.

Confidence at time $t$ and $t-1$

$$C_t = \int \alpha_1 \alpha_2 d\alpha$$

$$C_{t-1} = \int \alpha_1 \alpha_2 d\alpha$$

Change in Confidence

$$E = C_t - C_{t-1}$$

$$E \geq \theta \quad \text{Accept}$$

$$E < \theta \quad \text{Discard}$$

Experiment and Result
Disance sensors
Rapid adaptation is shown in shaded part with the proposed method
Adaptation without proposed method

With the algorithm the robot can learn and adapt rapidly to new user preference.