Context-adaptation based on Ontologies and Spreading Activation

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Context Adaptation in Spreadr
Idea behind Spreadr

- **Model based approach:**
  - A domain ontology is used to store structural information about the domain items
  - Items semantically linked to each other

- Each item has a certain **activation value** from [0…1]

- Categories and items with higher activation values are **more important**

- **Spreading Activation** is used to modify the activation values
Technical Background

- **Spring** Framework
  - Flexible Java-Framework for (Web-)Applicationen

- **JSP** and **Struts Tiles** for the view-components

- **OWL** (Web Ontology Language) for the specific models (domain.owl, time.owl,...)

- **JENA**
  - Java framework for building Semantic Web applications based on RDF, OWL,...
Ontologies

Nodes represent concepts and individuals

Links represent relations between concepts and individuals

Basic idea behind Spreading Activation: If one node is being selected, activate it and spread the activation within the network so that semantically related nodes are also activated.
Model aggregation

Models are created independently from each other (for purposes of clarity)

domain.owl

time.owl

Spreading Activation Network

location.owl

contextrelations.owl

It is possible to integrate other models (device.owl, user.owl,...)
Response generation in SPREADR

1. **URL Request**
2. **Context-Sensing & Reasoning:** Activation level adjustments by Spreading Activation
3. **Request Processing by the Controller:** Content composition, bean creation
4. **Node selection:** Based on the url an ontology entry is selected
5. **Visualization by the appropriate View:** JSP-View takes the model and displays the data
Context sensing

- **Context factors** are being recognized, e.g.:
  - The current **location** (location context)
  - The current **time** (time context)
  - The current **item** that has been selected (domain context)

- The appropriate **nodes are activated** in the Spreading Activation Network.

- These nodes are now activated with a certain value and spread their activation to semantically related nodes.
Spread of activation (1)

- After activating initial nodes their activation is being spread within the network
Spread of activation (2)

1. Put the initial nodes into a processing queue
   i. Take the node with the highest activation gain
   ii. Spread the activation (attenuated) to all neighbors
   iii. Mark the node as „processed“
   iv. Put new activated nodes into the queue (if not already „processed“)
   v. Check terminating condition
   vi. Go to i.
Constraints and Termination Conditions

- The **Spreading Activation** can be **constrained** by:
  - **Distance:** Don’t activate nodes that are too far away from the initial nodes.
  - **Fan-Out:** Don’t process nodes with more than k relations (too less specific nodes).
  - **Type:** Only spread through certain types of nodes and relations.
  - **Activation:** Only spread activation when it is above a certain threshold.

- The **Spreading Activation** will be **terminated** when:
  - The processing queue is empty
  - A predefined time limit has exceeded
  - A predefined number of processed nodes has exceeded
Spreading Activation in SPREADR

- Creation and manipulation of individualized user profiles as a foundation for he adaptation effects

- When a fresh session starts a SpreadAc network is being created from the ontologies
  - All SpreadAc networks are \textbf{identical in structure}
  - \textbf{Activation levels} (of the nodes) and \textbf{weights} (of the edges) individualize the SpreadAc networks

- Ranking and selection of concepts and individuals is based on activation level.
Learning in SPREADR

- Each relation has a certain **weight**.

- A high weight means that a relation is very **important**.

- The **higher** the relation weight, the **more activation** is transferred via that relation.

- If a recommendation is **accepted** by the user (by clicking on that item) the **paths that transported activation** to that node in the recent time are **amplified**.

- If a recommendation is ignored the paths are slightly **attenuated**.
Thank you for your attention