Group Formation in eLearning-enabled Online Social Networks

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Outline

Motivation

Classic eLearning environments

- Intra-group communication in predefined classrooms
- Managed by instructor
  - Creates groups
  - Analyses course results
  - Tracks learning progress

Online social networks (OSN)

- Socialize with friends
- Groups are user-triggered
- Ubiquitous use

How to provide a platform for self-paced learning on topics of personal interest?

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Motivation

Objectives & Challenges

- Our work focuses on integrating an OSN and an eLearning environment by removing the instructor
- Removal of instructor leads to challenges
  1. How to stimulate a team building process that is effective for learners?
  2. How to provide access to the relevant content for a learning group?
  3. How to facilitate a consistent learning progress, include feedback and corrective actions?

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eLearning-enabled OSN

Base Structure

- Extend commercial OSN by adding learning related features
- Communication is handled by commercial OSN via APIs
- All relevant objects are represented in the OSN

Classical representation of an OSN

eLearning-enabled OSN

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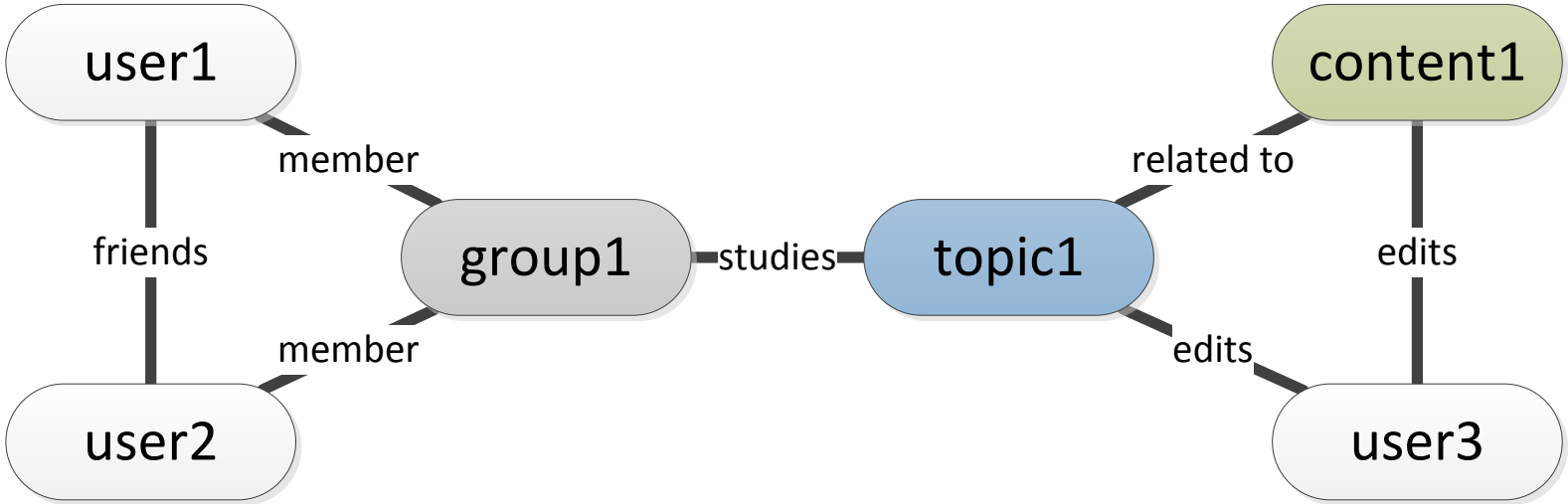
Representation using the unified approach



eLearning-enabled OSN

User Model

- Availability
  - Motivation of an user to start collaboration

eLearning-enabled OSN

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- Learning style (Felder & Silverman Theory)
  - Active or Reflective (Processing)
  - Visual or Verbal (Input)
  - Sensing or Intuitive (Perception)
  - Sequential or Global (Understanding)

eLearning-enabled OSN

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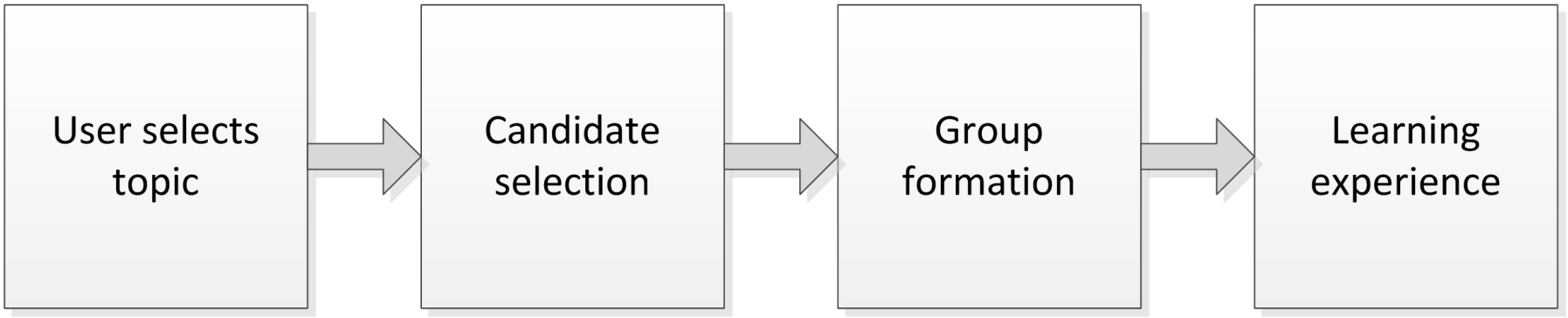
- Knowledge
  - Represented by tags
  - Each topic defines required tags with weights
  - Users also hold tags with an activity index
  - Knowledge Rank is calculated by product of weights and activity index

Group Formation

Overview



1. User initiate group building by selecting a topic, which requires collaboration

Group Formation

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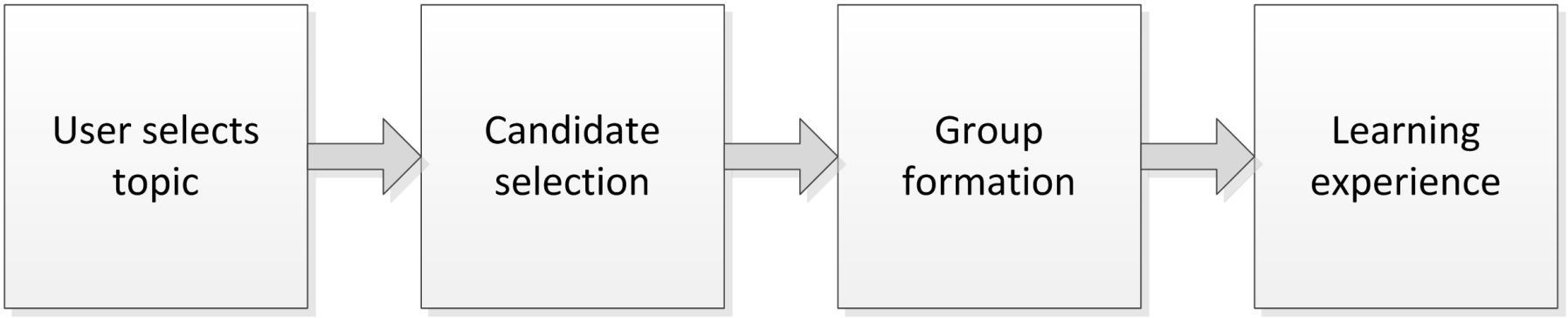

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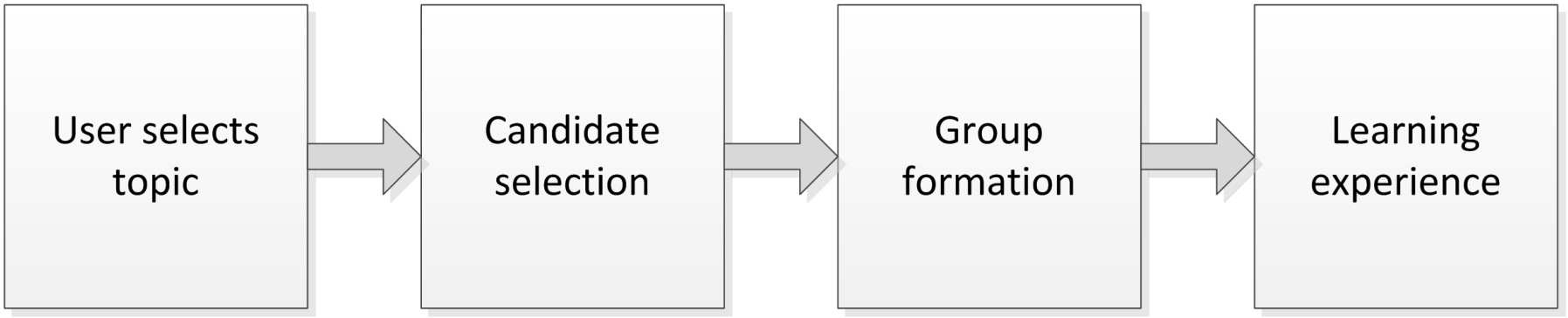

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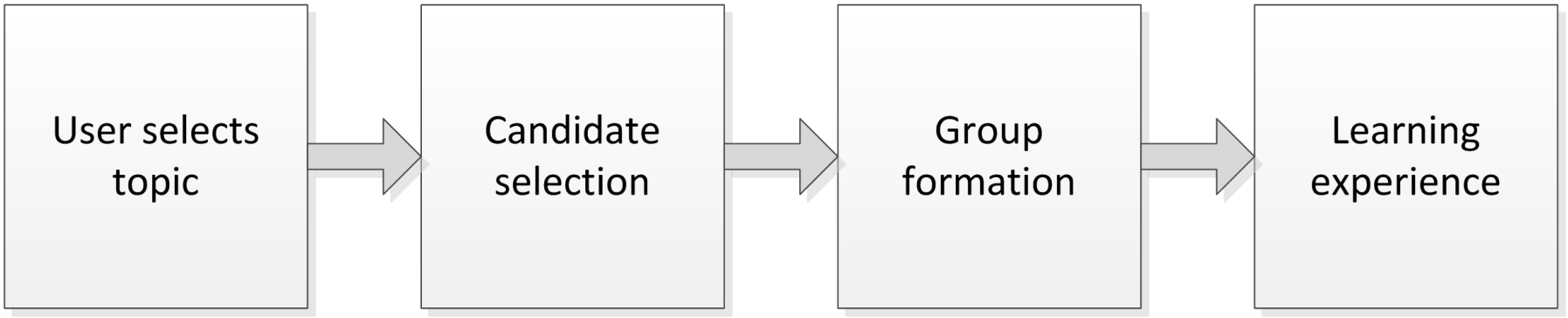


1. User initiate group building by selecting a topic, which requires collaboration
2. Starting at the initiator, the social network is searched for candidates
3. If a number of candidates is found, the group formation tries to find the best constellation
4. Selected users are invited and learning experience starts

Candidate Selection

- **Input**: social network, number of candidates, threshold
- Vertex is added to candidate set, if distance to initiator and topic is lower than threshold
- Distance formula includes learning style and knowledge rank (scale: 0 - 1)
- Implemented search algorithms:
  - Breath First Search(BFS)
  - Random Walk Search(RWS)
  - Best Connected Search(BCS)
- **Output**: candidate set

Group Formation

- **Input**: candidate set
- Group fitness defined by:
  - common learning style
  - high knowledge rank
  - low distance in social network
- Implemented by genetic algorithms to reduce complexity
  - Group constellations are treated as chromosomes in a population
  - In each generation cross-over and mutation operations are performed
  - Only constellations with a high fitness are selected for next generation
- **Output**: best group constellations

Evaluation

Open questions

1. How are the user attributes distributed?
2. What is the impact of search algorithms?
3. Does the threshold influence the search complexity?
4. Does the candidate count influence the group fitness?

Evaluation

Generating test data

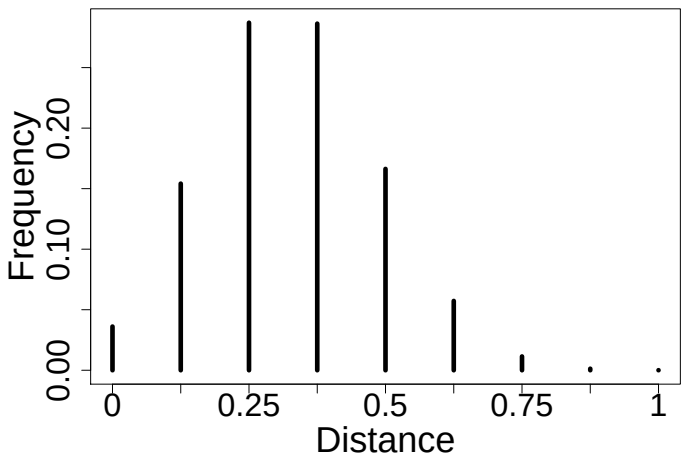
- No implementation exists and no appropriate test data
- Evaluation on synthetic data
- Simplification: Only user objects in the social network and all users are available
- Forest fire model was used to generate a social network with 1000 vertices and 31522 edges
- Challenge: How to distribute the user attributes?
  - Learning style: empirical data from Felder & Spurlin
  - Knowledge: 20 tags are power-law distributed over all vertices with random activity index

Evaluation

User Model

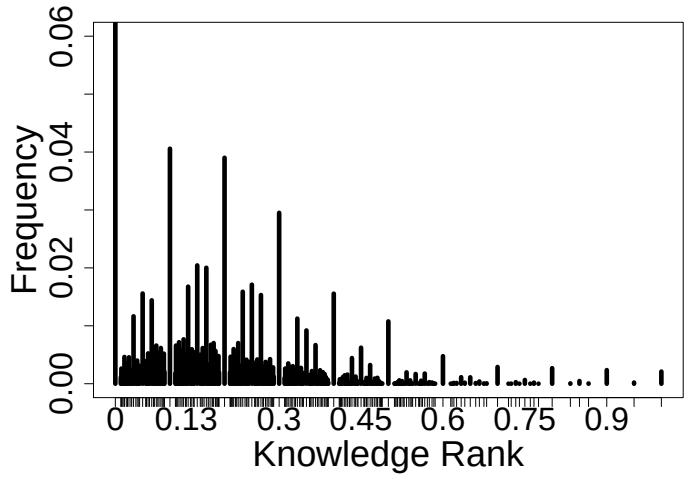
How are the user attributes distributed?

Distance in learning style



- Normal distribution
- Low average distance

Knowledge rank

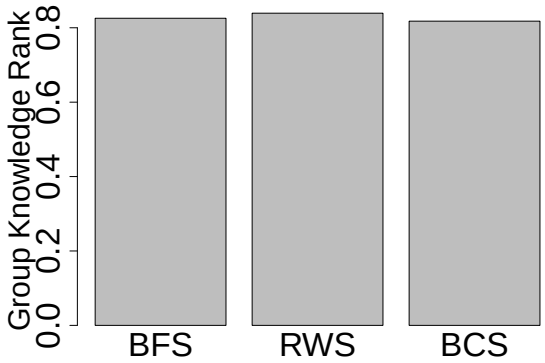


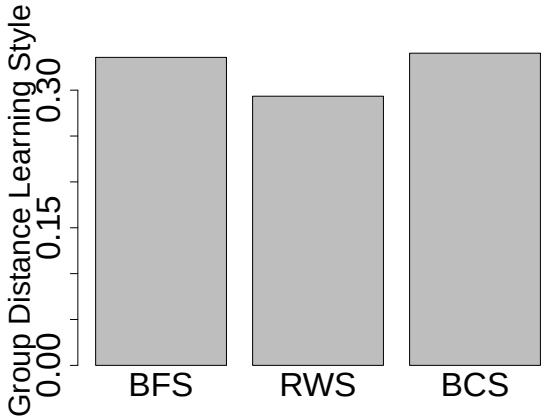
- 0 = 0.27
- Very low average knowledge rank

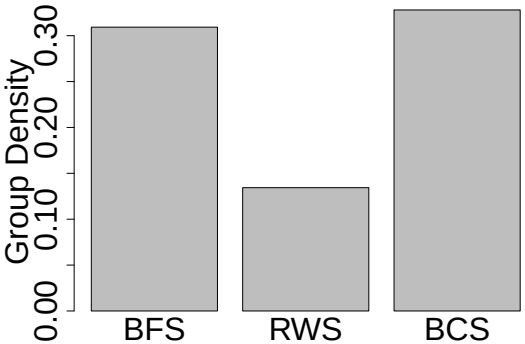
Evaluation

Candidate Selection

What is the impact of the search algorithms?





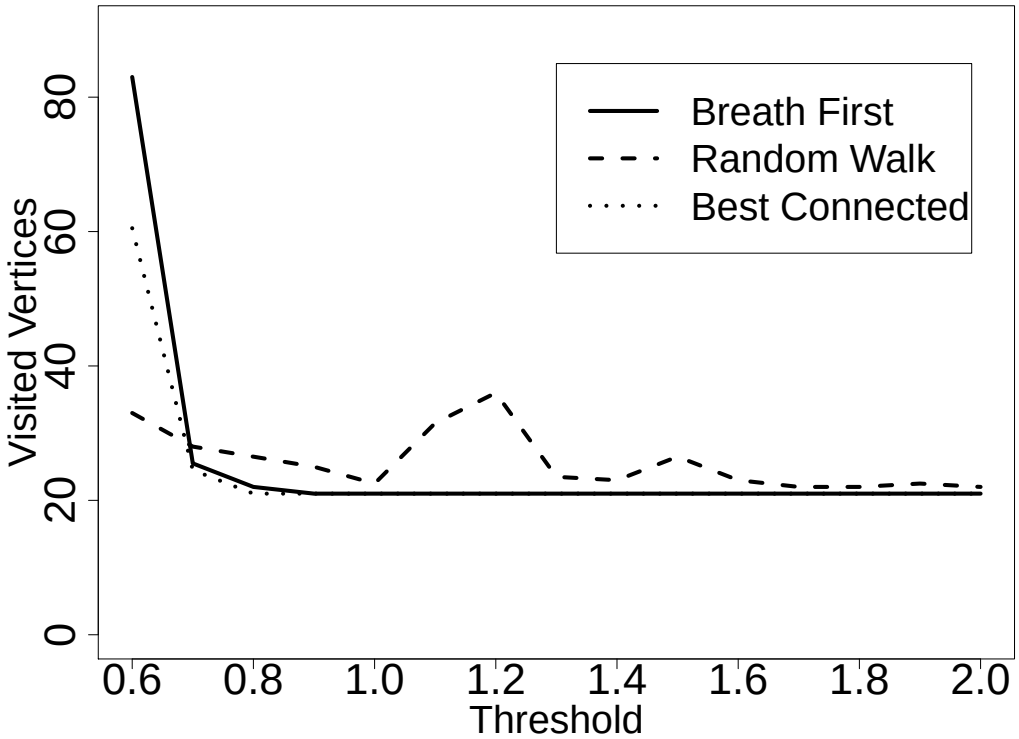


- No significant differences in distance of learning style and knowledge rank
- BFS and BCS produce nearly equal results
- RWS produce low group density

Evaluation

Candidate Selection

Does the threshold influence the search complexity?

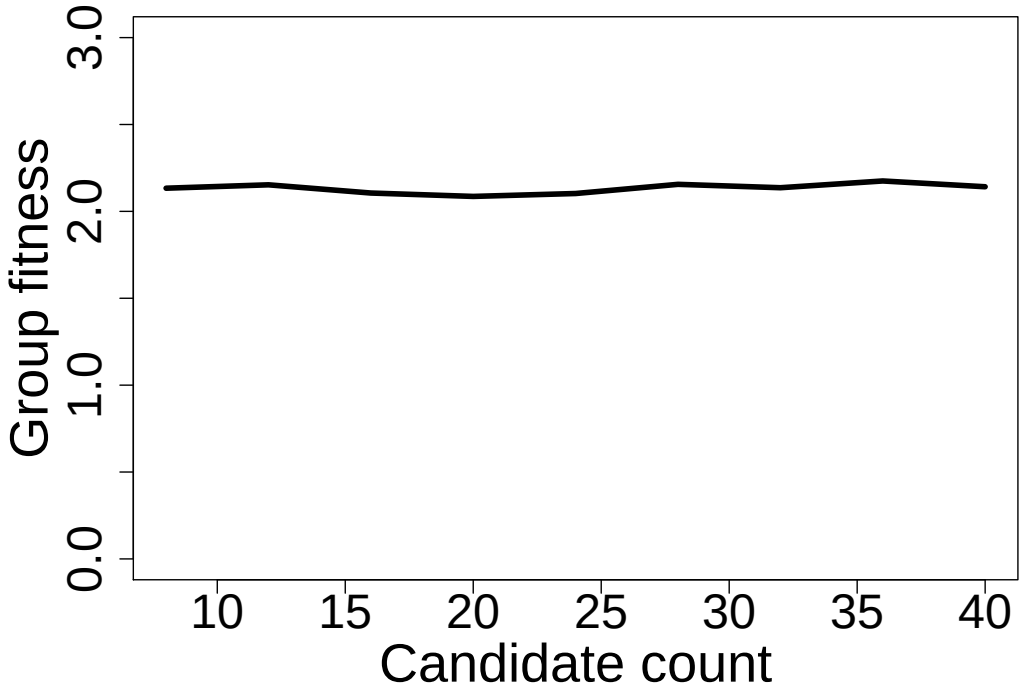


- RWS performs best if threshold < 0.7
- BFS and BCS convert at 0.9

Evaluation

Group Formation

Does the candidate count influence the group fitness?



- BFS was used to find candidates
- Threshold = 0.8
- No significant change in group fitness by increasing candidate count

Conclusion & Outlook

Problem: How to simulate a team building process that is effective for learners?

- User model includes availability, learning style and knowledge
- Approach divided in two parts:
  - Candidate selection
  - Group formation
- Evaluation based on synthetic data

Future research

- Improve data base by empirical data
- Include tie strength to take full advantage of unified approach