

@WI-IAT2022

Online Discussion Transition Analysis for Group Learning Support

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Background



Group work is effective for higher-order learning

- OECD and Japan urge group work in classrooms

Online tools use mechanisms, such as breakout rooms for group activities

- The mechanisms limit the participation of non-group members.
- Teachers find it difficult to monitor all the groups simultaneously



Background | Related works

- Visualizing system

Taoufiq et al. proposed a system using latent Dirichlet allocation (LDA) to visualize learners' discussions [8].

- Topic detection and tracking

A topic detection and tracking (TDT) algorithm for predicting future events after mining causal relationships [7]

It analyzes whether the entered news is on the same topic as previously reported as well as our discussion transition analysis

[8]: Taoufiq Zarra, Raddouane Chiheb, Rdouan Faizi, and Abdellatif El Afia. 2018. Student Interactions in Online Discussion Forums: Visual Analysis with LDA Topic Models. In LOPAL '18. Association for Computing Machinery, Article 30, 5 pages.

[7] Kira Radinsky and Sagie Davidovich. 2012. Learning to Predict from Textual Data. J. Artif. Int. Res. 45, 1, 641–684.

Objective | Supporting teachers



GAIL Teacher App

group_01 fgl NEW	group_02	group_03 808 岡田 NEW 湘南台
group_04 計算機の歴史 ジョーク NEW	group_05 全体 高度情報処理技術者試験 NEW	group_06 三角形 佐賀県道 NEW
group_07	group_07 OK 三角形 星座 NEW 学習院	group_08 NEW 臨床検査技師
group_09 いち 計算理論 NEW	group_10	group_none

Inspiration:
traffic light

Algorithm overview



Google Cloud
Speech-to-Text

Tokenizing

Entity detection
by
Google Cloud
Natural Language API

Entity &
Wikipedia Category
Analysis

Discussion
Transition
Analysis

Main
Theme
Analysis

Visualizing

Proposed algorithm





Discussion Transition Analysis

Assumption: although the discussion transition happens over time, the change is continuous

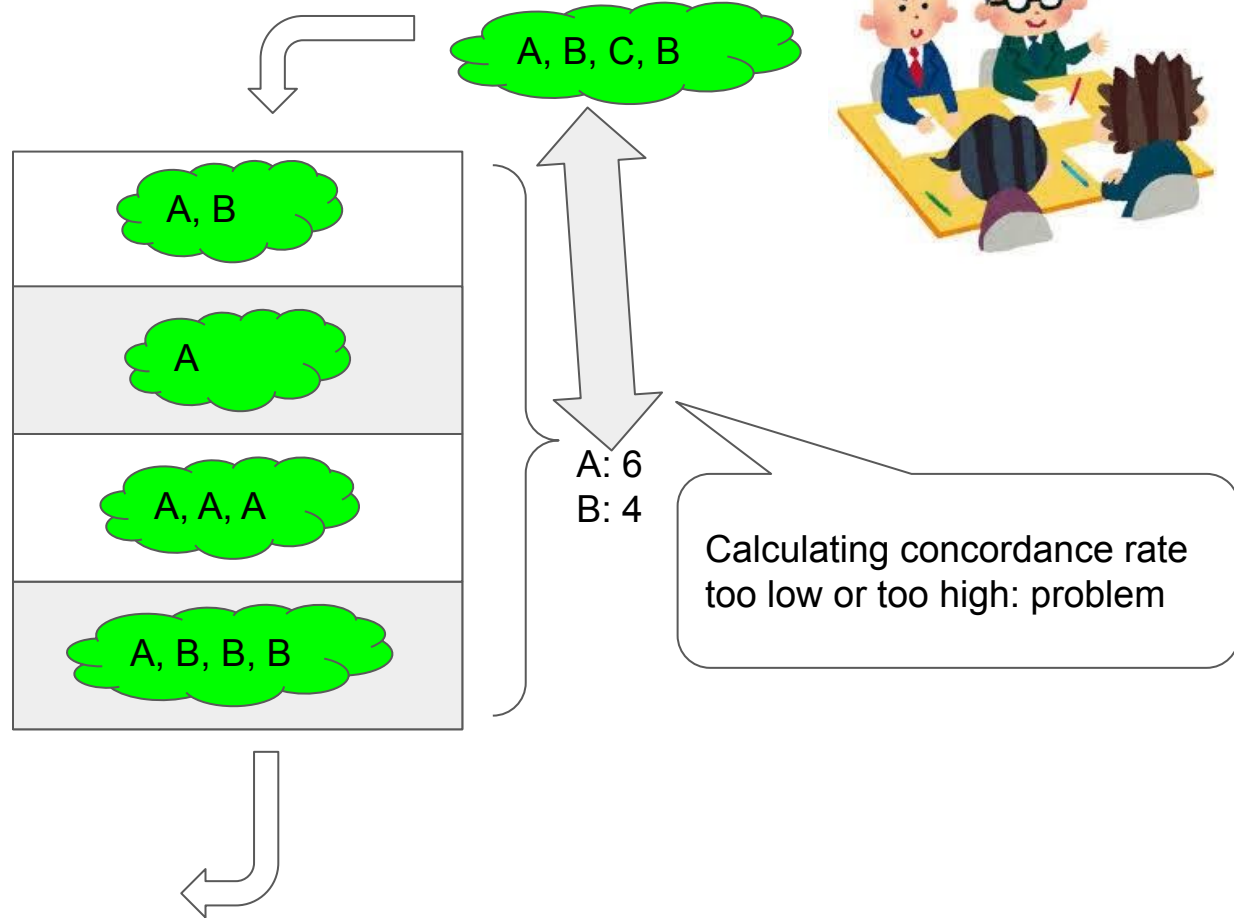
1. Queue model

Using only the most recent N pieces

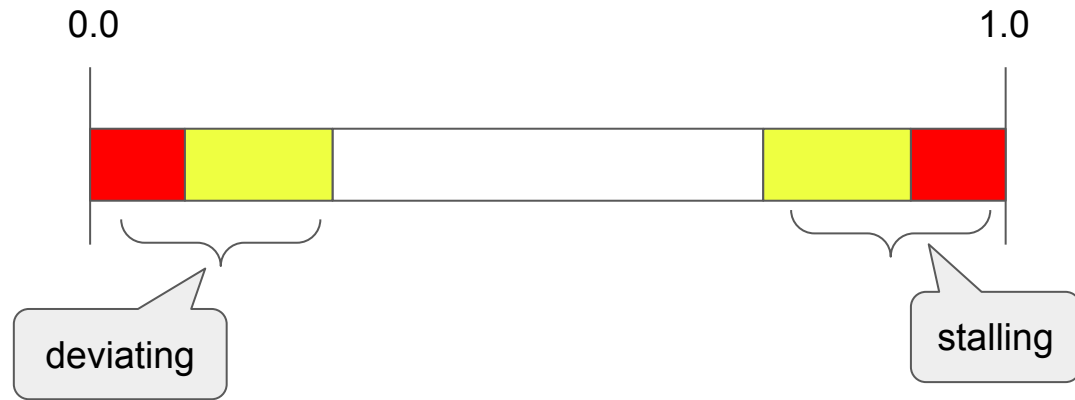
2. Memory model

that content discussed repeatedly for a long time is more important than the most recent content.

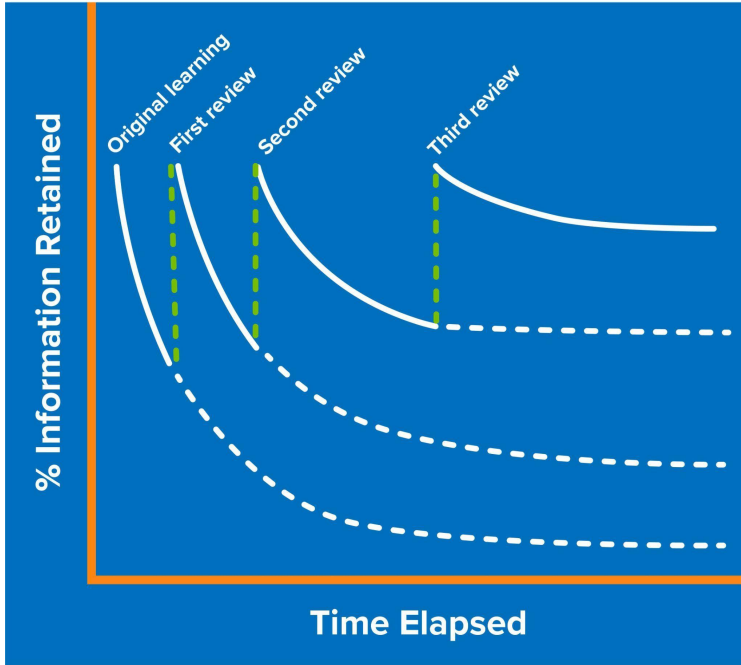
Queue model



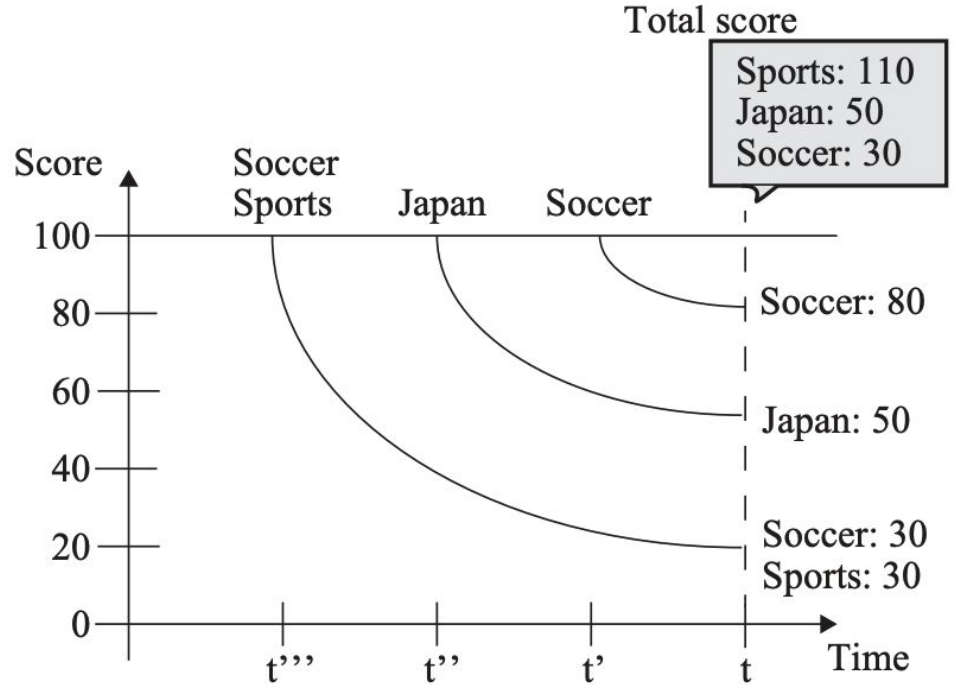
Concordance rate calculation : Jaccard coefficient



Memory model



Forgetting curve



Our model



Main theme analysis

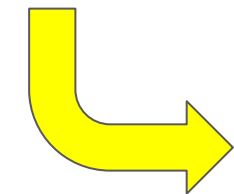
Using Wikipedia article as approximate solution

Helping the teacher to quickly understand what kind of conversation the group was having



Main theme analysis

Example: *If we draw this straight line, we get triangle three.*



Explicit
Semantic
Analysis

Triangle, Vertex perpendicular (triangle), Right triangle



Doc2Vec
Center of gravity

Main theme

Triangle



Evaluation

Dataset: W2E and real discussion text

- W2E has 1,781 event texts from Wikipedia

Baselines:

- TDT: discussion transition analysis [7]
- LDA: main theme analysis



Evaluation

Proposed algorithms

- **97% of properly** transitioning text could be analyzed as **correct**.
- **100% of inappropriate** conversation data could be **analyzed as inappropriate**.
- **Correctness rate** for main theme analysis is also **70%**.

Baselines:

- TDT: 28.5% correct ratio
- LDA: 32%



Conclusion

- We proposed algorithms to support teachers in monitoring group learning sessions easily
- The proposed queue model provided faster results for discussion transition analysis, whereas the proposed memory model was more accurate

Thank you!!!