NISTS 2023
BE A CONNECTOR FOR TRANSFER STUDENT SUCCESS
Virtual • February 1-3 | Portland, OR • February 22-24

Educational Session

2820 - Using AI to Streamline Transfer Credit Assessment: PathwAI

Credits and Degree Pathways, Leadership and Strategic Planning

The PathwAI Online Learning Outcomes Analysis System represents an innovative approach to assessing transfer credit. PathwAI automates the process of evaluating course equivalencies and facilitates institutional collaboration through the application of artificial intelligence (AI). This session explains the potential for incorporating AI into transfer credit assessment and provides a demonstration of PathwAI. Participants will have the opportunity to ask questions, provide feedback, and learn about potential future developments in this area.

Kaylin Kainulainen, *Project Coordinator*
Andrew Fisher, *Software Developer*
Vijay Mago, *Associate Professor and FSES Research Chair*
Lakehead University

USING AI TO STREAMLINE TRANSFER CREDIT ASSESSMENT

PATHWAI

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Lakehead University, Thunder Bay, Canada

NISTS 2023
February 23, 2023

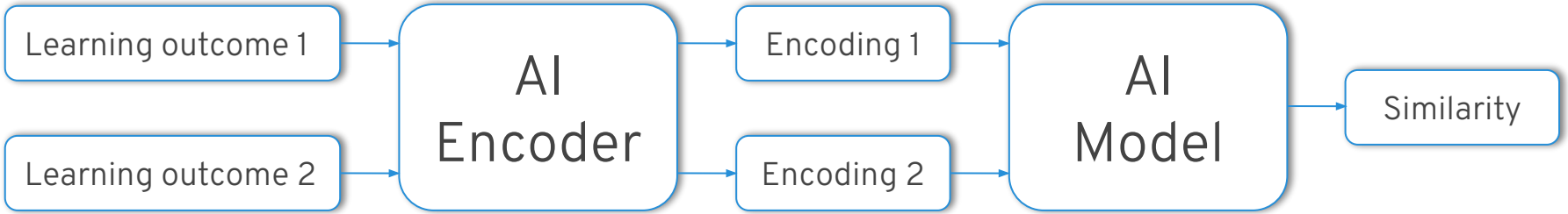
TABLE OF CONTENTS

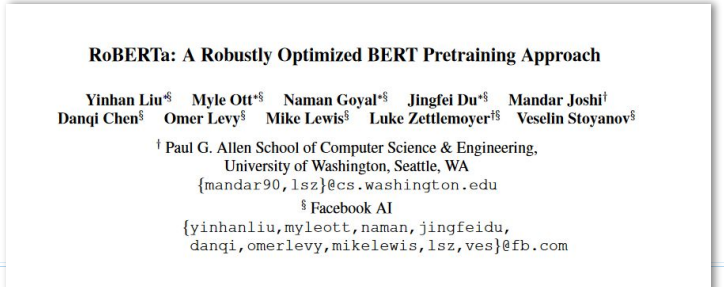
1 NATURAL LANGUAGE PROCESSING (NLP)

How can it streamline transfer credit assessment?

NLP AND SEMANTIC SIMILARITY ASSESSMENT

- What is natural language processing?
- How does it process textual information?
- Which algorithm is our platform using?





RoBERTa: A Robustly Optimized BERT Pretraining Approach

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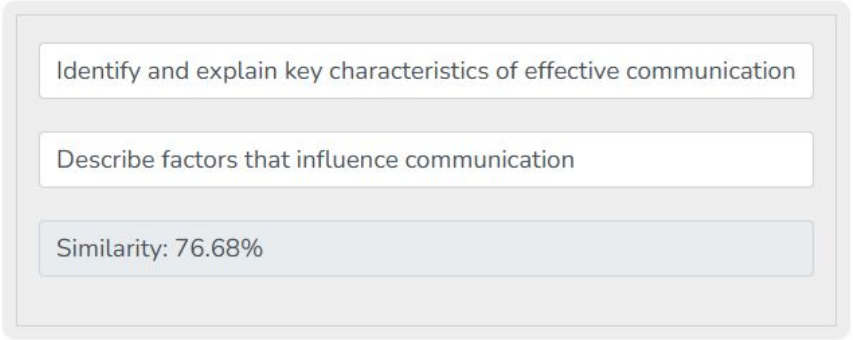
NLP AND SEMANTIC SIMILARITY ASSESSMENT

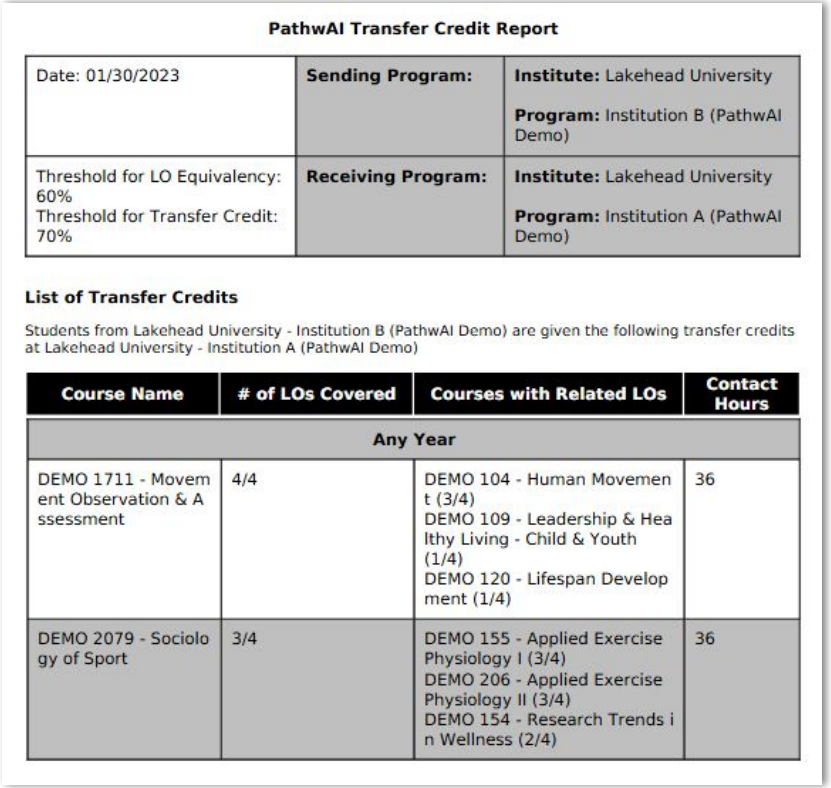
- How is semantic similarity assessed?
- What factors influence the outcomes of a semantic similarity assessment?



NLP IN THE CONTEXT OF TRANSFER

- Transfer credit assessment strategies and processes
- Challenges of transfer credit assessment

HOW CAN NLP ADDRESS CHALLENGES?



PathwAI Transfer Credit Report

Date: 01/30/2023	**Sending Program:**	**Institute:** Lakehead University **Program:** Institution B (PathwAI Demo)
Threshold for LO Equivalency: 60% Threshold for Transfer Credit: 70%	**Receiving Program:**	**Institute:** Lakehead University **Program:** Institution A (PathwAI Demo)

List of Transfer Credits

Students from Lakehead University - Institution B (PathwAI Demo) are given the following transfer credits at Lakehead University - Institution A (PathwAI Demo)

Course Name	# of LOs Covered	Courses with Related LOs	Contact Hours
Any Year			
DEMO 1711 - Movement Observation & Assessment	4/4	DEMO 104 - Human Movement (3/4) DEMO 109 - Leadership & Healthy Living - Child & Youth (1/4) DEMO 120 - Lifespan Development (1/4)	36
DEMO 2079 - Sociology of Sport	3/4	DEMO 155 - Applied Exercise Physiology I (3/4) DEMO 206 - Applied Exercise Physiology II (3/4) DEMO 154 - Research Trends in Wellness (2/4)	36

2

DATALAB

Who is developing this technology?

RESEARCH

Laboratory in the Department of Computer Science at Lakehead University

FOCUSED

Conducting research that can be applied to real-world social and economic problems

WEBSITE

datalab.science

3

PATHWAI

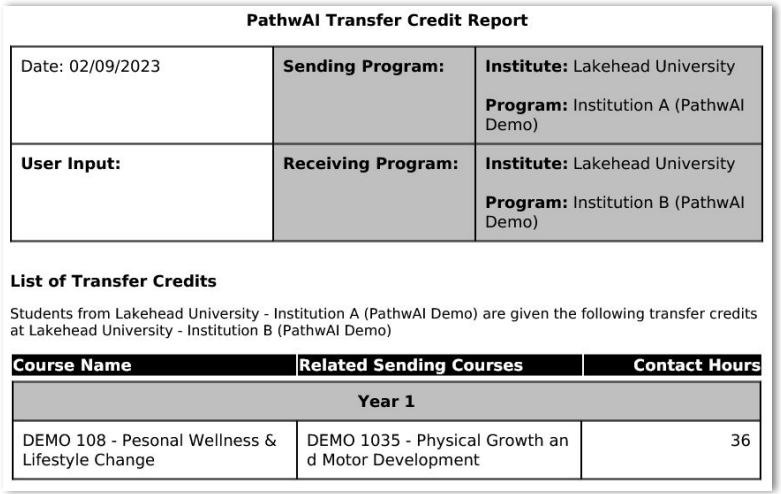
How does a web interface interact with AI?

WHAT IS PATHWAI?

- Online platform designed to support collaborative analysis of curricula across programs and institutions
- Compares course descriptions and learning outcomes by determining semantic similarity
- Tool for equivalency analyses and pathway development projects

WHAT IS PATHWAI?

- PathwAI report presents the recommendations from AI
- Detailed report presents the finalized decisions after reviewing user input



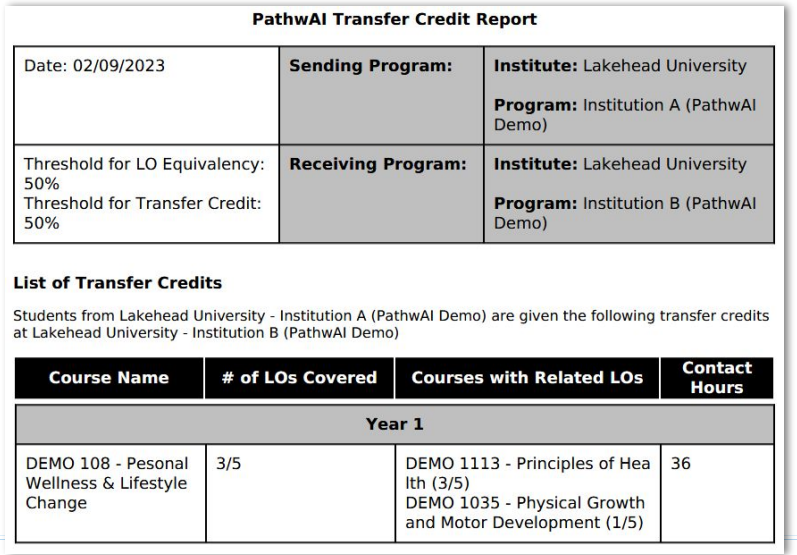
PathwAI Transfer Credit Report

Date: 02/09/2023	**Sending Program:**	**Institute:** Lakehead University **Program:** Institution A (PathwAI Demo)
User Input:	**Receiving Program:**	**Institute:** Lakehead University **Program:** Institution B (PathwAI Demo)

List of Transfer Credits

Students from Lakehead University - Institution A (PathwAI Demo) are given the following transfer credits at Lakehead University - Institution B (PathwAI Demo)

Course Name	Related Sending Courses	Contact Hours
Year 1		
DEMO 108 - Pesonal Wellness & Lifestyle Change	DEMO 1035 - Physical Growth and Motor Development	36



PathwAI Transfer Credit Report

Date: 02/09/2023	**Sending Program:**	**Institute:** Lakehead University **Program:** Institution A (PathwAI Demo)
Threshold for LO Equivalency: 50% Threshold for Transfer Credit: 50%	**Receiving Program:**	**Institute:** Lakehead University **Program:** Institution B (PathwAI Demo)

List of Transfer Credits

Students from Lakehead University - Institution A (PathwAI Demo) are given the following transfer credits at Lakehead University - Institution B (PathwAI Demo)

Course Name	# of LOs Covered	Courses with Related LOs	Contact Hours
Year 1			
DEMO 108 - Pesonal Wellness & Lifestyle Change	3/5	DEMO 1113 - Principles of Health (3/5) DEMO 1035 - Physical Growth and Motor Development (1/5)	36

BRIEF HISTORY OF PATHWAI

- Inspiration for PathwAI
- Partnership with ONCAT
- Evolution of processing speeds over time
- Current iteration

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TRANSFER CREDIT ASSESSMENT

What are the current challenges?

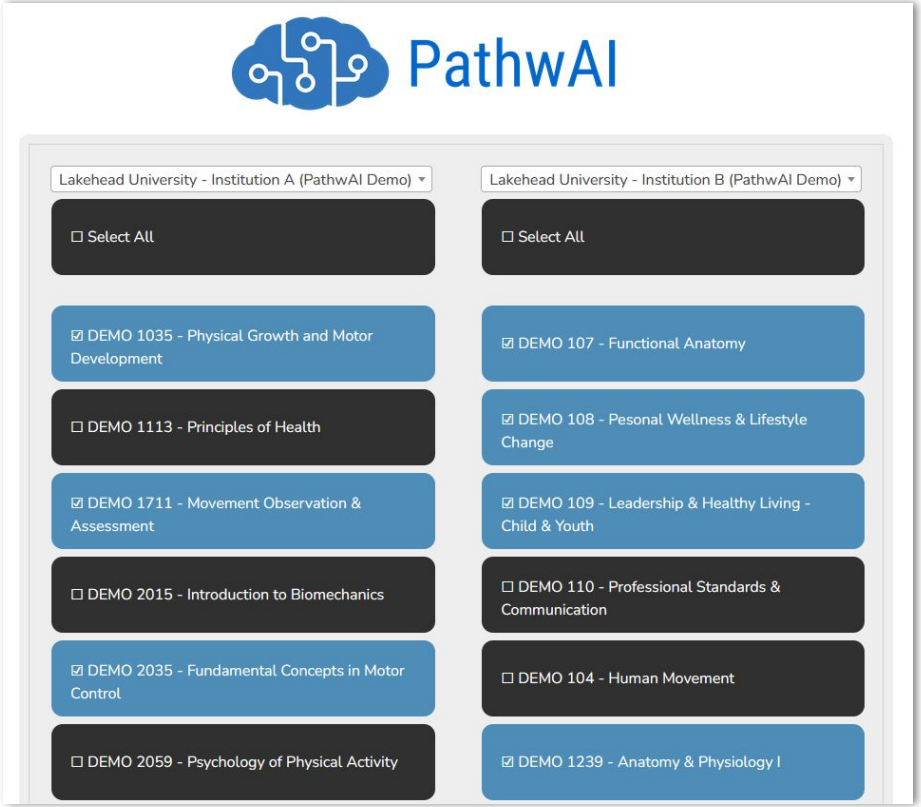
TRANSFER CREDIT ASSESSMENT

Challenges:

- Time-consuming
- Large volumes of information
- No standard protocol for comparison
- Potential for subjectivity or bias

PathwAI

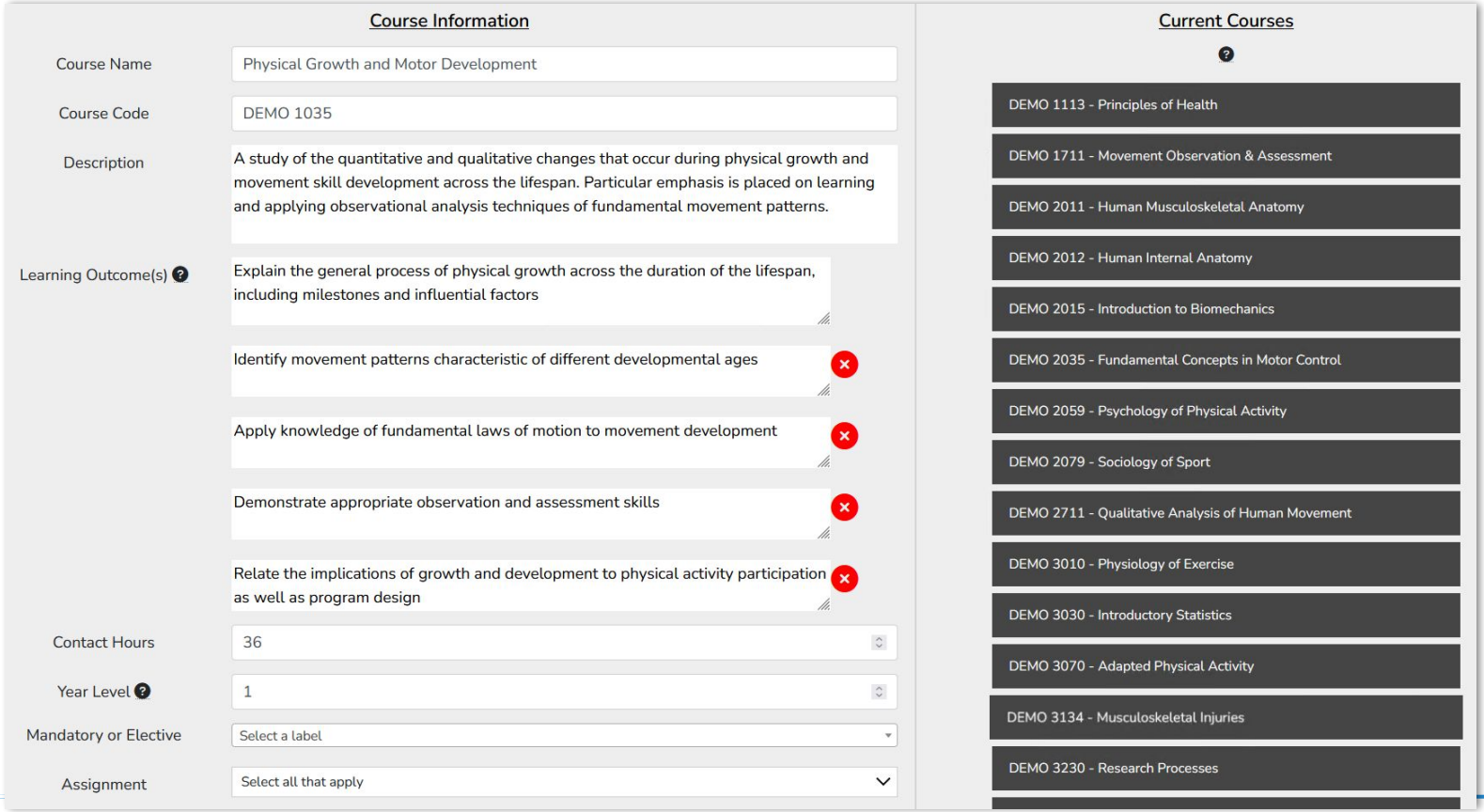
- Automation
- Dataset
- Standardized protocol



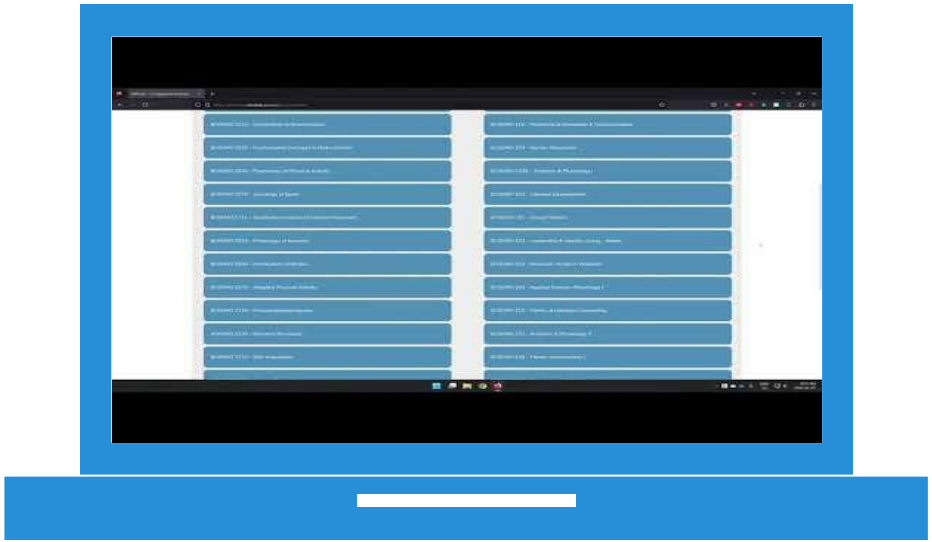
HOW DOES PATHWAI EVALUATE TRANSFER CREDIT?

- Learning outcomes
- Course to course comparison
- Semantic similarity

HOW DOES PATHWAI EVALUATE TRANSFER CREDIT?



5 LIVE DEMONSTRATION



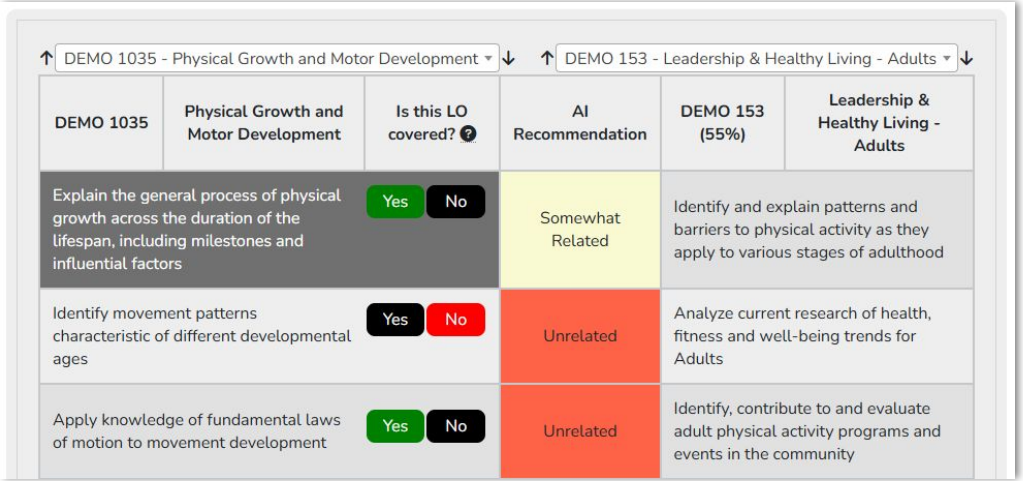
A preview of PathwAI's current iteration

PathwAI

pathwai.datalab.science

PATHWAI EXAMPLE

- Content Experts (faculty, coordinators)
- PathwAI Report
- How does content expert evaluation compare to PathwAI output?



DEMO 1035 - Physical Growth and Motor Development

DEMO 153 - Leadership & Healthy Living - Adults

DEMO 1035	Physical Growth and Motor Development	Is this LO covered?	AI Recommendation	DEMO 153 (55%)	Leadership & Healthy Living - Adults
Explain the general process of physical growth across the duration of the lifespan, including milestones and influential factors		Yes / No	Somewhat Related	Identify and explain patterns and barriers to physical activity as they apply to various stages of adulthood	
Identify movement patterns characteristic of different developmental ages		Yes / No	Unrelated	Analyze current research of health, fitness and well-being trends for Adults	
Apply knowledge of fundamental laws of motion to movement development		Yes / No	Unrelated	Identify, contribute to and evaluate adult physical activity programs and events in the community	

Institution A (Credits)	Institution B	
	Content Experts	*PathwAI Report*
DEMO 1035	DEMO 120 DEMO 109 DEMO 153	1. DEMO 109 2. DEMO 120 3. DEMO 153
DEMO 1113	DEMO 108	1. DEMO 202 2. DEMO 108 3. DEMO 154
DEMO 3010	DEMO 155 DEMO 206	1. DEMO 155 2. DEMO 206 3. DEMO 104
DEMO 3070	DEMO 153 DEMO 204	1. DEMO 109 2. DEMO 204 3. DEMO 153
DEMO 3711	DEMO 156 DEMO 207 DEMO 251	1. DEMO 154 2. DEMO 155 3. DEMO 156
DEMO 4113	DEMO 210	1. DEMO 210 2. DEMO 207 3. DEMO 255

HOW DID PATHWAI COMPARE?

- PathwAI was able to identify similar course equivalencies when compared to the content expert evaluation

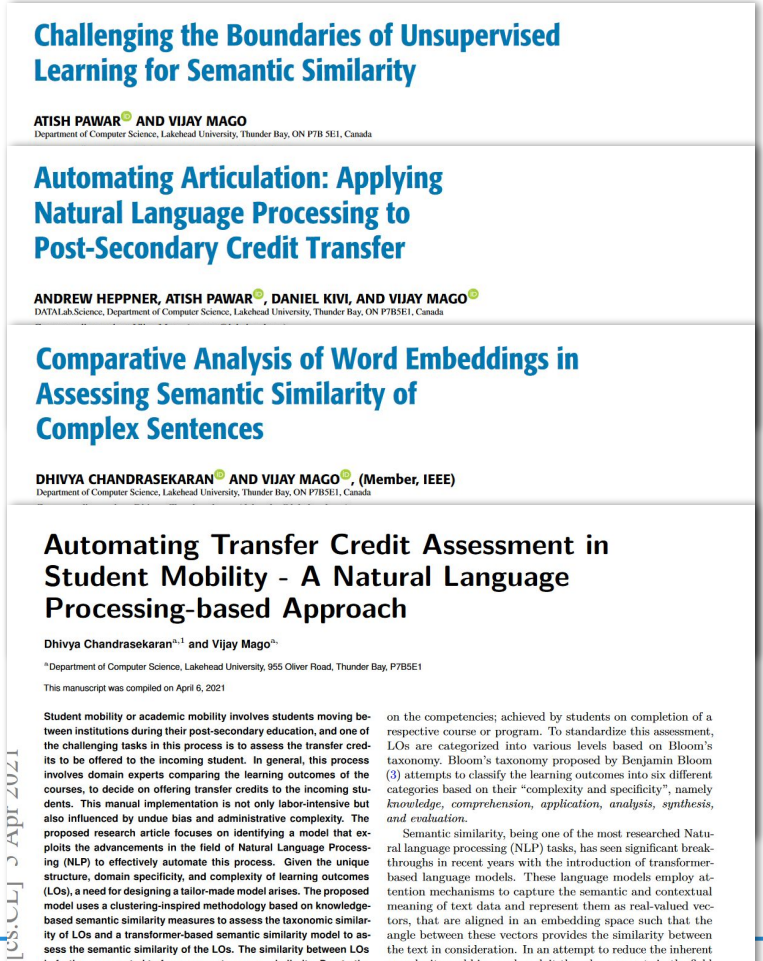
- Ability to confirm identified courses and/or identify courses not yet considered

6 CURRENT RESEARCH

What is currently being done in this field?

RESEARCH

- Pawar, A., & Mago, V. (2019). Challenging the boundaries of unsupervised learning for semantic similarity.
- Heppner, A., Pawar, A., Kivi, D., & Mago, V. (2019). Automating articulation: Applying natural language processing to post-secondary credit transfer.
- Chandrasekaran, D., & Mago, V. (2021). Comparative analysis of word embeddings in assessing semantic similarity of complex sentences.
- Chandrasekaran, D., & Mago, V. (2022). Automating Transfer Credit Assessment in Student Mobility- A Natural Language Processing-based Approach.



Challenging the Boundaries of Unsupervised Learning for Semantic Similarity

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Automating Articulation: Applying Natural Language Processing to Post-Secondary Credit Transfer

ANDREW HEPPNER, ATISH PAWAR, DANIEL KIVI, AND VIJAY MAGO
DATALab.Science, Department of Computer Science, Lakehead University, Thunder Bay, ON P7B5E1, Canada

Comparative Analysis of Word Embeddings in Assessing Semantic Similarity of Complex Sentences

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Automating Transfer Credit Assessment in Student Mobility - A Natural Language Processing-based Approach

Dhivya Chandrasekaran and Vijay Mago
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This manuscript was compiled on April 6, 2021

Student mobility or academic mobility involves students moving between institutions during their post-secondary education, and one of the challenging tasks in this process is to assess the transfer credits to be offered to the incoming student. In general, this process involves domain experts comparing the learning outcomes of the courses, to decide on offering transfer credits to the incoming students. This manual implementation is not only labor-intensive but also influenced by undue bias and administrative complexity. The proposed research article focuses on identifying a model that exploits the advancements in the field of Natural Language Processing (NLP) to effectively automate this process. Given the unique structure, domain specificity, and complexity of learning outcomes (LOs), a need for designing a tailor-made model arises. The proposed model uses a clustering-inspired methodology based on knowledge-based semantic similarity measures to assess the taxonomic similarity of LOs and a transformer-based semantic similarity model to assess the semantic similarity of the LOs. The similarity between LOs

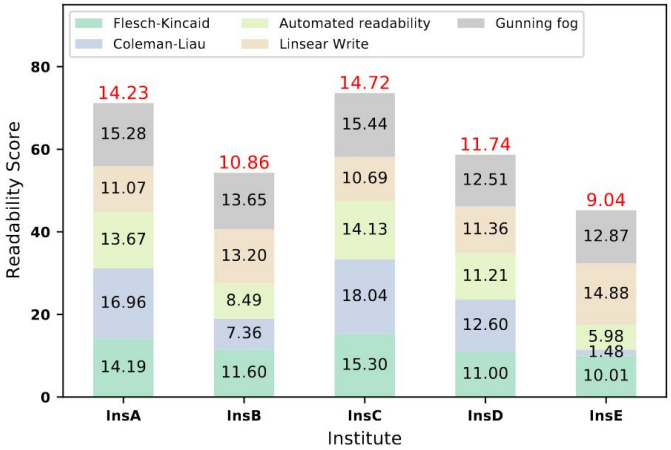
on the competencies; achieved by students on completion of a respective course or program. To standardize this assessment, LOs are categorized into various levels based on Bloom's taxonomy. Bloom's taxonomy proposed by Benjamin Bloom (3) attempts to classify the learning outcomes into six different categories based on their "complexity and specificity", namely *knowledge, comprehension, application, analysis, synthesis, and evaluation.*

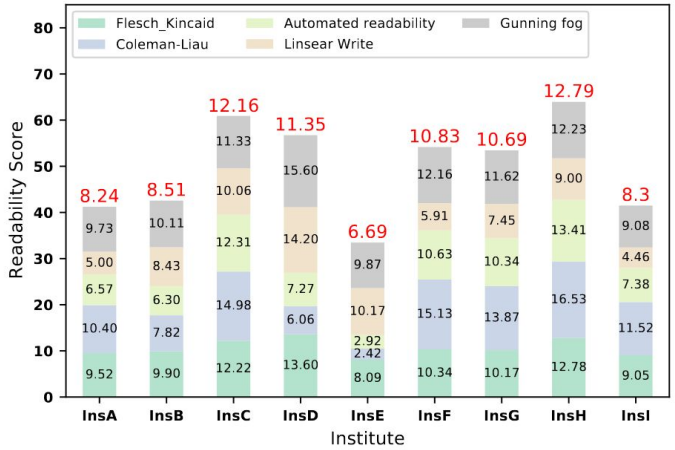
Semantic similarity, being one of the most researched Natural language processing (NLP) tasks, has seen significant breakthroughs in recent years with the introduction of transformer-based language models. These language models employ attention mechanisms to capture the semantic and contextual meaning of text data and represent them as real-valued vectors, that are aligned in an embedding space such that the angle between these vectors provides the similarity between the text in consideration. In an attempt to reduce the inherent

[cs.CL] 5 Apr 2021

RESEARCH

- Facilitating learning outcome assessment- development of new datasets and analysis of pre-trained language models
- Open-source project that is currently under peer review
- Develops two novel learning outcome datasets and analyzes the results of multiple AI models as well as multiple readability measures





RESEARCH

- Collectively, these studies represent a foundation for future research that will further investigate, explore, and enhance the relationship between artificial intelligence (AI) and postsecondary transfer

- Research using the PathwAI platform continues to be conducted with exciting insights and developments

REFERENCES

- Liu, Y., Ott, M., Goyal, N., Du, J., Joshi, M., Chen, D., ... & Stoyanov, V. (2019). Roberta: A robustly optimized bert pretraining approach. arXiv preprint arXiv:1907.11692.
- Pawar, A., & Mago, V. (2019). Challenging the boundaries of unsupervised learning for semantic similarity.
- Heppner, A., Pawar, A., Kivi, D., & Mago, V. (2019). Automating articulation: Applying natural language processing to post-secondary credit transfer.
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- Chandrasekaran, D., & Mago, V. (2022). Automating Transfer Credit Assessment in Student Mobility- A Natural Language Processing-based Approach.
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THANK YOU

Do you have any questions?

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