

RCIR @ NTCIR-16

Reading Comprehension in Information Retrieval

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Reading Comprehension

Can we tell from a person's eye movements whether they've **comprehended** the text they've read on screen?

And can we use this information as part of the retrieval process for text content?



Eye movements when reading text

When tracking a person's eye movements when they are reading, we observe different types of reading behaviors ...

Sequential reading of text

Scanning (with an information need)

Skimming (under pressure)

...

Core text reading behaviours in the real world



Eye movements when reading text

And different types of reading behaviors are associated with different patterns of comprehension

Dual quaternions and 4×4 homogeneous transform

It might be helpful, especially in rigid body motion, to represent unit dual quaternions as: $\hat{q} = r + d\epsilon r$ where r and d are both quaternions. The r quaternion part or displacement part.

The rotation part can be given by

$$r = r_w + r_x i + r_y j + r_z k = \cos\left(\frac{\theta}{2}\right) + \sin\left(\frac{\theta}{2}\right) (\vec{a} \cdot (i, j, k))$$

where θ is the angle of rotation about the direction given by unit vector \vec{a} . The

$$d = 0 + \frac{\Delta x}{2} i + \frac{\Delta y}{2} j + \frac{\Delta z}{2} k.$$

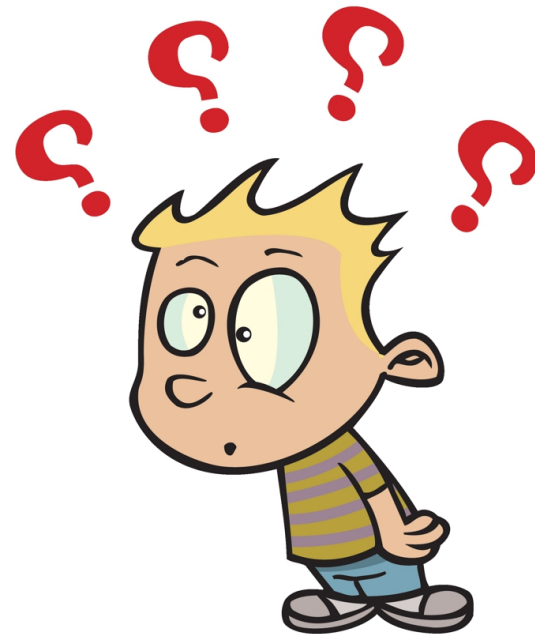
The dual-quaternion equivalent of a 3D-vector is

$$\hat{v} := 1 + \epsilon(v_x i + v_y j + v_z k)$$

and its transformation by \hat{q} is given by^[13]

$$\hat{v}' = \hat{q} \cdot \hat{v} \cdot \overline{\hat{q}}^*.$$

These dual quaternions (or actually their transformations on 3D-vectors) can



Reading Comprehension

Text Comprehension is multifaceted and complex: literal, inferential, predictive, evaluative, applied, ...

We will focus on **literal** for this pilot task (more later).

So, by comprehension we mean whether they can answer some questions about the text they've just read...

Figure 1: Grid for Developing and Evaluating Reading Comprehension Questions

Forms of Questions	Types of Comprehension					Personal Response
	Literal	Reorganization	Inference	Prediction	Evaluation	
Yes/No						
Alternative						
True or False						
Who/What/ When/Where/ How/Why						
Multiple Choice						

Day, R. R., & Park, J. S. (2005). Developing Reading Comprehension Questions. *Reading in a foreign language*, 17(1), 60-73.

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Two sub-tasks

Sub-task 1:

Comprehension-
evaluation task (CET)

Focus: Sort texts by
their comprehension
scores using biosignal
measures

Sub-task 2:

Comprehension-based
retrieval task (CRT)

Focus: Retrieve/rank
texts (for a variety of
topics) by
comprehension . score

Data Collection Experiment

Instruction

Read the text on the following screen. You will be examined (via a quiz) on its content later.

Condition

Trial



Test



- **96 texts** per participant X **10 participants**
- 4 induced reading conditions: sequential, scanning, skimming, proof reading

Experiment/ Data

- 24 text topics (sourced from Wikipedia)
 - Each user-text pair with a measured comprehension score
 - Mix of short and long texts
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- Training set of 480 trials (containing 12 topics)
 - Testing set of 480 trials (containing 12 topics and 12 topics not in training set)

Comprehension-evaluation Task

Sub-task 1:

Predict the comprehension score for each user-text pair in the test set. Evaluated via e.g. MSE

Sub-task 2:

Retrieve topics (24) and rank by comprehension score. Evaluated via e.g. Discounted Cumulative Gain

Data / Resources

Resources Provided:

- Preprocessed (and raw) eye tracker data for each trial, pre-computed features, etc
- Baseline system, code
- Submission system examples
- Training / test
- And more

Measures

- Eye tracker, EOG, etc

Timeline*

- Sept 2021 - Task Registration
- Sept 2021 – Dataset Release
- Dec 2021 – Test/dry runs
- Jan 2022 – Formal runs
- Feb 2022 - Evaluation result release
- Feb 2022 – Draft Task Overview Paper release
- Mar 2022 – Draft Task Participant Papers due
- Apr 2022 – Camera ready submission due

This is a tentative timeline. The finalised timeline will be published at:
ntcir-rcir.computing.dcu.ie

Thank you

Thank you for your time

- If you have any queries (or suggestions) please feel free to email me: graham.healy@dcu.ie
- Please check out ntcir-rcir.computing.dcu.ie (more detail soon)

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