Project Title

Application of Semantic Textual Similarity in Contract Review

Project Lead and Members

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Organisation(s) Involved

ALPS Pte Ltd

Healthcare Family Group Involved in this Project

Healthcare Administration

Specialty or Discipline

Finance, Procurement

Aims

To improve the Master Agreement review process with artificial intelligence and natural language processing (NLP)

Background

See poster appended / below

Methods

See poster appended / below

Results

See poster appended / below

Lessons Learnt

See poster appended / below

Conclusion

See poster appended / below

Additional Information

Singapore Healthcare Management (SHM) Conference 2021 – Shortlisted Project (Supply Chain Management Category)

Project Category

Technology, Digital Health, Data Analytics, Artificial Intelligence, Care & Process Redesign, Quality Improvement, Job Effectiveness, Value Based Care, Operational Management, Supply Chain, Procurement, Inventory Management

Keywords

Natural Language Processing, Legal Documentation, Google Universal Sentence Encoder

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ALPS
Synergies in Healthcare Supply Chain

Introduction

ALPS handles a large number of vendor contracts. All of the contracts contain "Master Agreement" as the key legal documentation.

The master agreement is more than 20 pages long, with more than 40 clauses. It would take a legally trained person a few hours to complete a review.

We developed an application with artificial intelligence and natural language processing (NLP) techniques to improve the process.

The application can intelligently find out terms and clauses that are "out of specification" from standard contract templates within minutes.

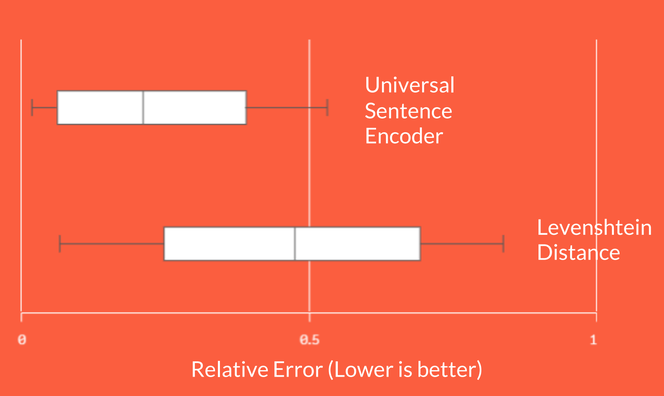
Methodology

OCR → Split → Encode → Compare → Score

1) Use OCR to extract text from signed contracts pdf file.
2) Split the contracts into clauses and then sentences.
3) Encode sentence into high dimensional vectors with a deep learning model (Google Universal Sentence Encoder). The model is trained to abstracts semantic meanings from texts.
4) For each clause, perform a two-way semantic similarity comparison between the contract and a standard template at sentence level using the high dimensional vectors.
5) Score each sentence in the contract. Aggregate the score for each clause and the entire contract.

Results

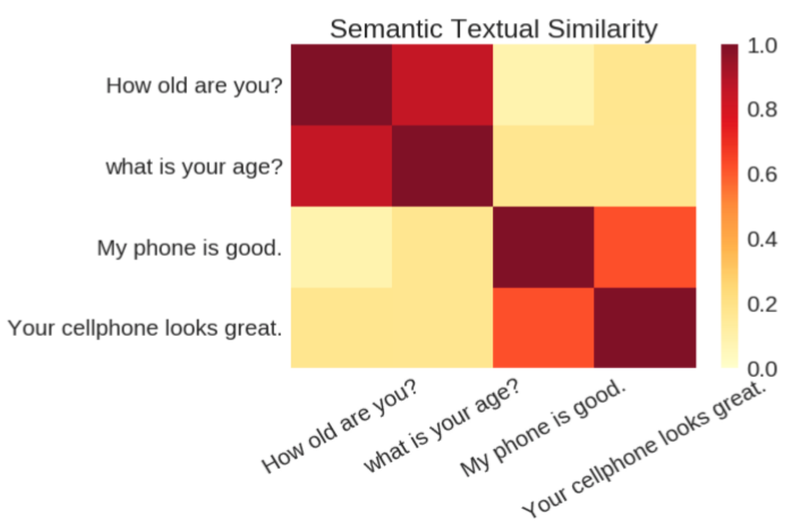
1) Evaluated with 600 sentence pairs from ALPS contracts, the semantic text similarity is near 2x more effective, as compared to the non-deep learning text similarity method.



2) We tested the application with 22 actual contracts. The analysis finished in 30 mins and detected significant out of specification clauses in 2 out of the 22 contracts.

Conclusion

The application demonstrated the efficiency and improvement NLP techniques could bring to niche areas, such as the contract review process in supply chain management. Inspired by this application, other NLP applications such as text summarization and question and answering can be explored in future.



An illustration of semantic text similarity

Clause	Score	Actual	Template
WAIVER	58.9	any waiver by the company of any of its rights shall only be effective if made in writing to the vendor. in the event any company should walve any of its rights under any relevant purchase order or contract, such company shall be deemed to have walved those rights only on that partlcular occasion, and shall have the right to assert in full its rights on any subsequent occasion.	36.1 any waiver by the company of any of its rights shall only be effective if made in writing to the vendor. in the event any company should waive any of its rights under any relevant purchase order or contract, such company shall be deemed to have waived those rights only on that particular occasion, and shall have the right to assert in full its rights on any subsequent occasion. 36.2 no payment for, review, acceptance or approval of any product by any company will operate as a waiver of the vendor's obligations in a contract, any vendor standard warranty, any manufacturer or sub-contractor warranty, or the rights of the company.

A demonstration showing the application detects missing term (red colour) in actual contract's "Waiver" clause, as compared to the template.