

# DETECTION OF DUPLICATES AMONG NON-STRUCTURED DATA FROM DIFFERENT DATA SOURCES

## SITUATION

When assessing a commercial risk, an insurer needs to gather various information about the risk. This long and complex process implies numerous questions. Thus an insurer is prompt to use an external source to help reduce the number of questions.

Thus, we want to detect duplicate of commercial risk in another data source using as **little** as possible information [Beauchemin and Lamontagne, 2020].

## SITUATION

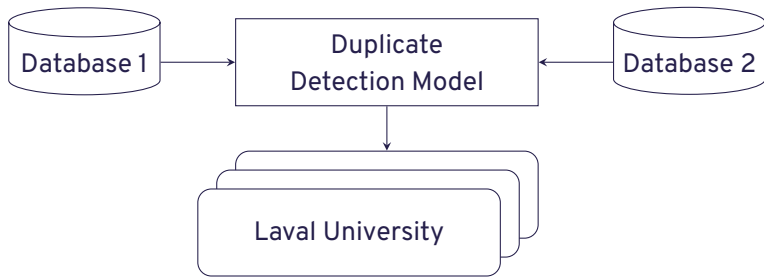
When assessing a commercial risk, an insurer needs to gather various information about the risk. This long and complex process implies numerous questions. Thus an insurer is prompt to use an external source to help reduce the number of questions.

Thus, we want to detect duplicate of commercial risk in another data source using as **little** as possible information [Beauchemin and Lamontagne, 2020].

### Example

David Beauchemin, the owner of "Beauchemin inc.", calls for insurance. Using minimal information, we want to retrieve as much as possible from an external source to ask him as less than the necessary number of questions.

## HOW DO WE DETECT DUPLICATE?



# DATABASES

- **Registre des Entreprises du Québec** (~3.5 millions entries)
  - Names
  - Address
  - Economic activities
  - Administrative informations
- **Private dataset** (21,444 enterprises)
  - Name
  - Address
  - Economic activity

## PRIVATE DATASET AND THE REQ

11,649 commercial risk are in the province of Quebec, 1706 were annotated

- 1418 (*commercial risk, REQ entity*)
- 288 (*commercial risk, None*).

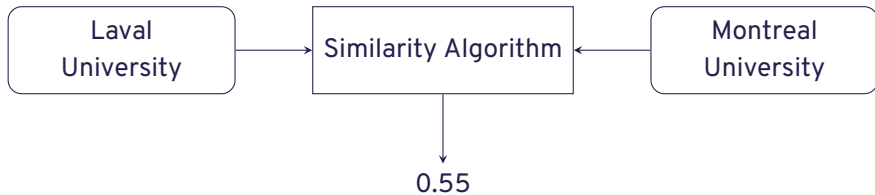
We only use the name and the address<sup>1</sup>.

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1. Addresses and names are normalize (not included in the presentation).

## **Similarity Between Two Entities**

## SIMILARITY ALGORITHM





## SIMILARITY ALGORITHM

Similarities algorithms are one that measures the resemblance between two string base on the distance between their tokens.

## NAME INTERESTING RESULTS

	StoS	Jaro-Winkler	Jaccard
Recall (%)	44.15	64.95	<b>65.87</b>

## ADDRESS INTERESTING RESULTS

	StoS	Jaro-Winkler	CSS
Recall (%)	13.19	49.79	<b>50.36</b>

## MISSING ADDRESSES

Since 16% (270) of the pair (*commercial risk*, *REQ entity*) are missing a address, the results are under-evaluated. For example, the CSS accuracy without those pairs is at 62.20% near 12% higher.

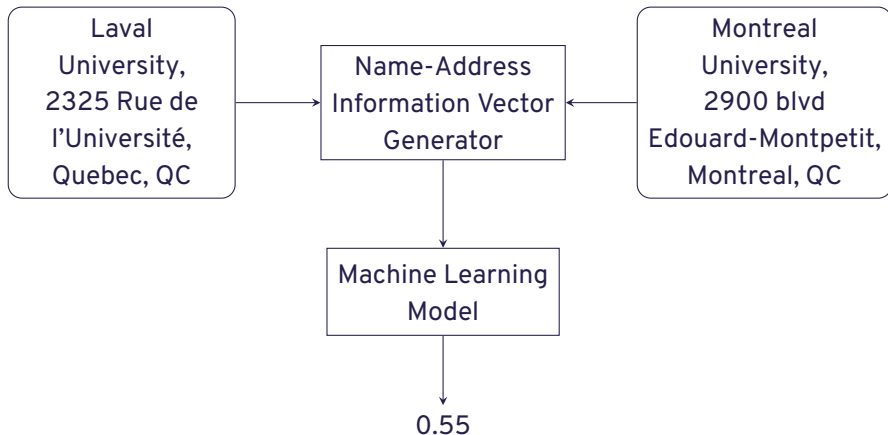
Those missing addresses are due to the confidentiality policy of the REQ [Registraire des entreprises du Québec, 2017].

## SIMILARITY ALGORITHM SUMMARY

Using either name or address, the similarities algorithms allows us to find the matched entity around 50% of the time.

The leading approach been Jaccard using the name at near 67%.

## MACHINE LEARNING SIMILARITY ALGORITHM



## NAME-ADDRESS INFORMATION VECTOR GENERATOR

We used the previous similarity algorithm to generate an information vector between two entities using the name and address.

### Example of an information vector

StoS	Levenshtein	Jaro-Winkler	LCSP	Jaccard	Cosinus	-
0.00	0.15	0.25	0.35	0.15	0.15	-
StoS	Levenshtein	Jaro	LCSP	Jaccard	Cosinus	CSS
0.00	0.16	0.55	0.15	0.45	0.37	0.48

## RESULTS

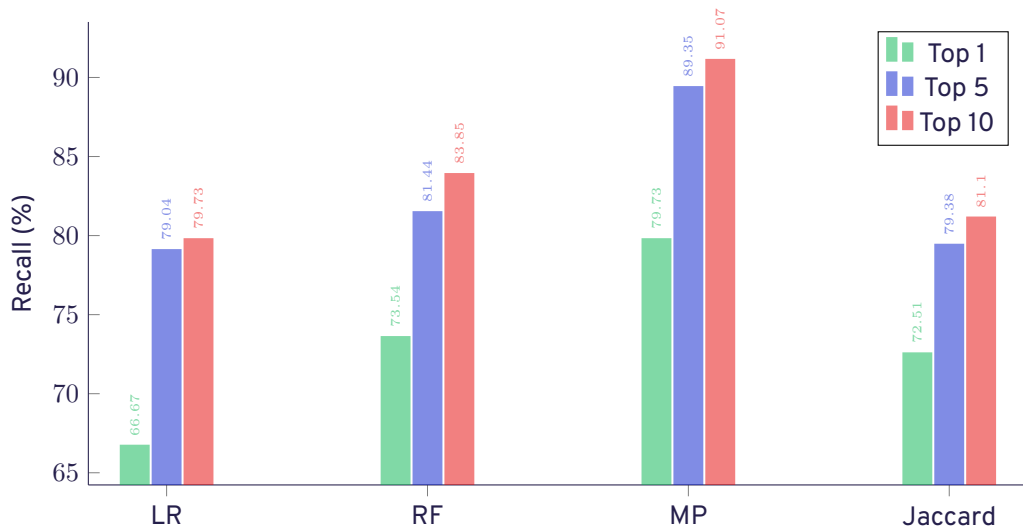
(%)	Logistic Regression	Random Forest	Multilayer perceptron	Jaccard
Recall	66,67	73,54	<b>79,73</b>	72,51



## IMPROVING THE RESULTS - $N$ MOST SIMILAR

We consider a matching is good when the pair (*commercial risk*, *REQ entity*) is included in the  $N$  most similar.

## RESULTS



## MACHINE LEARNING ALGORITHM SUMMARY

The used of name and address simultaneously with a machine learning algorithm improved the results.

Using a top  $N$  approach helps achieve better results when  $N$  is greater than 1.

## FUTURE WORKS

- Word embeddings [Mikolov et al., 2013, Pennington et al., 2014, Wu et al., 2017, Foxcroft et al., 2019, Singh et al., 2019]
- Siamese Network [Godbole et al., 2018, Imtiaz et al., 2020]
- Uses of spatial data [Sehgal et al., 2006]
- Removal of more specific stop words using a TF-IDF approach [Sammut and Webb, 2010]

## CONCLUSION

- We have shown that using a similarity algorithm can achieve good results.
- Uses of machine learning algorithm (such as multilayer perceptron) can achieve greater results.
- Using a  $N$  most similar approach, where  $N$  is greater than one, help improved the results, achieving almost the max recall value.




## ACKNOWLEDGMENTS

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# THANK YOU FOR LISTENING!

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