MANIFEST CLIMATE

TCFD-NLP: Assessing alignment of climate disclosures using NLP for the financial markets

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Manifest Climate

Climate risk planning startup

We support organizations in understanding, managing, and communicating climate risks and opportunities

Software product supported by climate expertise

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Climate-related financial disclosures

Increased investor and regulatory pressure has led to climate reporting frameworks including the Task Force on Climate-Related Financial disclosures (TCFD)

TCFD has 11 recommendations

Governance	Strategy	Risk Management	Metrics and Targets
Board supervision	Climate risks and opportunities	Processes for identifying and assessing climate risks	Climate metrics
Management responsibilities	Impacts from climate risks and opportunities	Processes for managing climate risks	Greenhouse gas emissions
	Climate scenarios	Integration of climate risks management	Climate targets

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Climate Disclosure Reviews

Teck Climate Change Outlook 2021

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6 [1] Recommendations of the Task Force on Climate-related Disclosures. Task Force on Climate-related Financial Disclosures. June 2017

Annual Reports, Proxy Statements, ESG reports, etc

Disclosure review

Climate content - 11 TCFD categories

"Our Board of Directors and senior management are involved in assessing climate-related…." - **Board Supervision**
"In 2021, RBC EL used a tool called Transition Check to assess the transition risk impacts to a substantial portion of its wholesale loan exposures in the energy…."- **Climate Scenarios**
Management responsibility
Climate risks/opportunities
Integration of climate risk management
Climate metrics
Climate targets
GHG emissions
…

Non-climate content

1. _____
2. _____
3. _____
….

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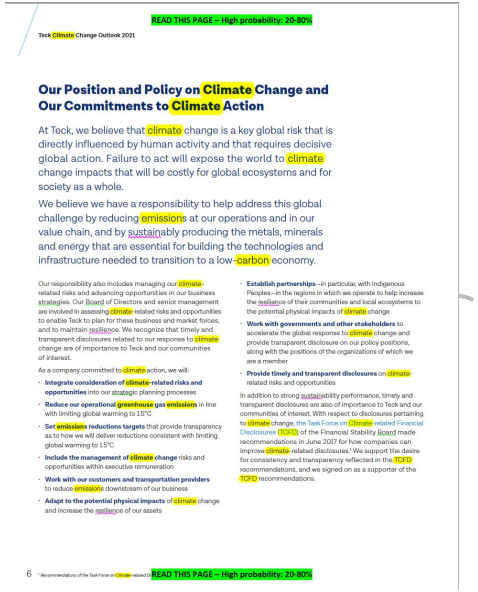

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Data processing

Model training

PDF tagging

Disclosure review (data labelling)

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Climate impact

Problem
Assessing TCFD-alignment is time-consuming (climate content is spread across many reports, often 100s of pages long)

Solution
Build NLP models to classify report text into categories

Impact
Enables large-scale analysis of corporate climate disclosure across sectors, geographies etc.

Helps companies to uncover gaps in how they are managing and communicating climate risks/opportunities

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Data

> 1000 reports labelled across industries

2 million sentences labelled with TCFD recommendations and non-relevancy

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1. Baseline

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TF-IDF vectorizer

Random Forest multi-label classifier

- Board supervision
- Climate risks
- ...
- Management responsibility
- Non relevant

TF-IDF is trained on pages that contain TCFD-relevant information.
RF is trained with a ratio of 2 negative pages for each positive page.

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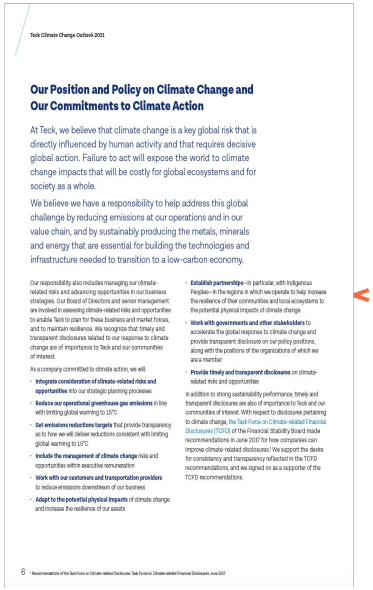
2. Fine-tuning language models



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Pre-trained DistilRoBERTa

Pre-trained ClimateBERT

Board supervision

Climate risks

...

Management responsibility

Non relevant

Both are fine-tuned with a classification head (paragraph level).
Downsample the negative paragraphs to the ones appearing next to the positive ones.

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3. Sentence-transformers and multi-label kNN

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Sentence transformers (DistilRoBERTa) as feature selection

Multi-label kNN

- Board supervision
- Climate risks
- ...
- Management responsibility
- Non relevant

The multi-label kNN uses the cosine distance.

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4. Stacked models

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1. TF-IDF + Random Forest

2. Pre-trained DistilRoBERTa

3. Pre-trained ClimateBERT

4. Sentence transformers + multi-label kNN

- Board supervision
- Climate risks
- ...
- Management responsibility
- Non relevant

The 3 models are only applied to the pages predicted as TCFD-relevant by the baseline.

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Preliminary results

Table 1: ROC-AUC scores at the file level for every TCFD recommendation.

File level ROC-AUC	TF-IDF (1)	kNN (2)	FT ClimateBERT (3)	FT distilRoBERTa (4)	(1) + (2)	(1) + (3)	(1) + (4)
Average AUC	0.867	0.847	0.852	0.819	**0.884**	0.865	0.857
Governance A	0.891	0.854	0.865	0.854	**0.91**	0.887	0.875
Governance B	**0.835**	0.812	0.809	0.795	0.832	0.823	0.823
Strategy A	0.844	0.875	0.834	0.766	**0.888**	0.841	0.838
Strategy B	0.877	0.874	0.853	0.824	**0.896**	0.864	0.852
Strategy C	**0.881**	0.845	0.856	0.805	0.866	0.86	0.854
Risk Management A	0.874	0.919	0.89	0.845	**0.935**	0.893	0.874
Risk Management B	0.839	0.882	0.871	0.836	**0.882**	0.88	0.862
Risk Management C	0.864	**0.941**	0.862	0.836	0.931	0.892	0.882
Metrics and Targets A	0.859	0.758	0.869	0.79	**0.895**	0.888	0.876
Metrics and Targets B	**0.932**	0.8	0.87	0.864	0.875	0.877	0.882
Metrics and Targets C	**0.843**	0.773	0.795	0.796	0.814	0.816	0.813

Not enough data on each recommendation to fine-tune language models.
Fine-tuned ClimateBERT offers a boost in performance.
A mix of keyword and embedding based methods seems to be the best.

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Next steps

Fine-tune language models

Given the results using ClimateBERT, we want to fine-tune the sentence transformers model with our data

Better combination of models

Experiment with different model stacking, e.g. per recommendation or per industry

Introduce domain knowledge

Find a way to augment the keyword-based model with more domain expertise rules

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