

# Applying Natural Language Processing on Financial Texts

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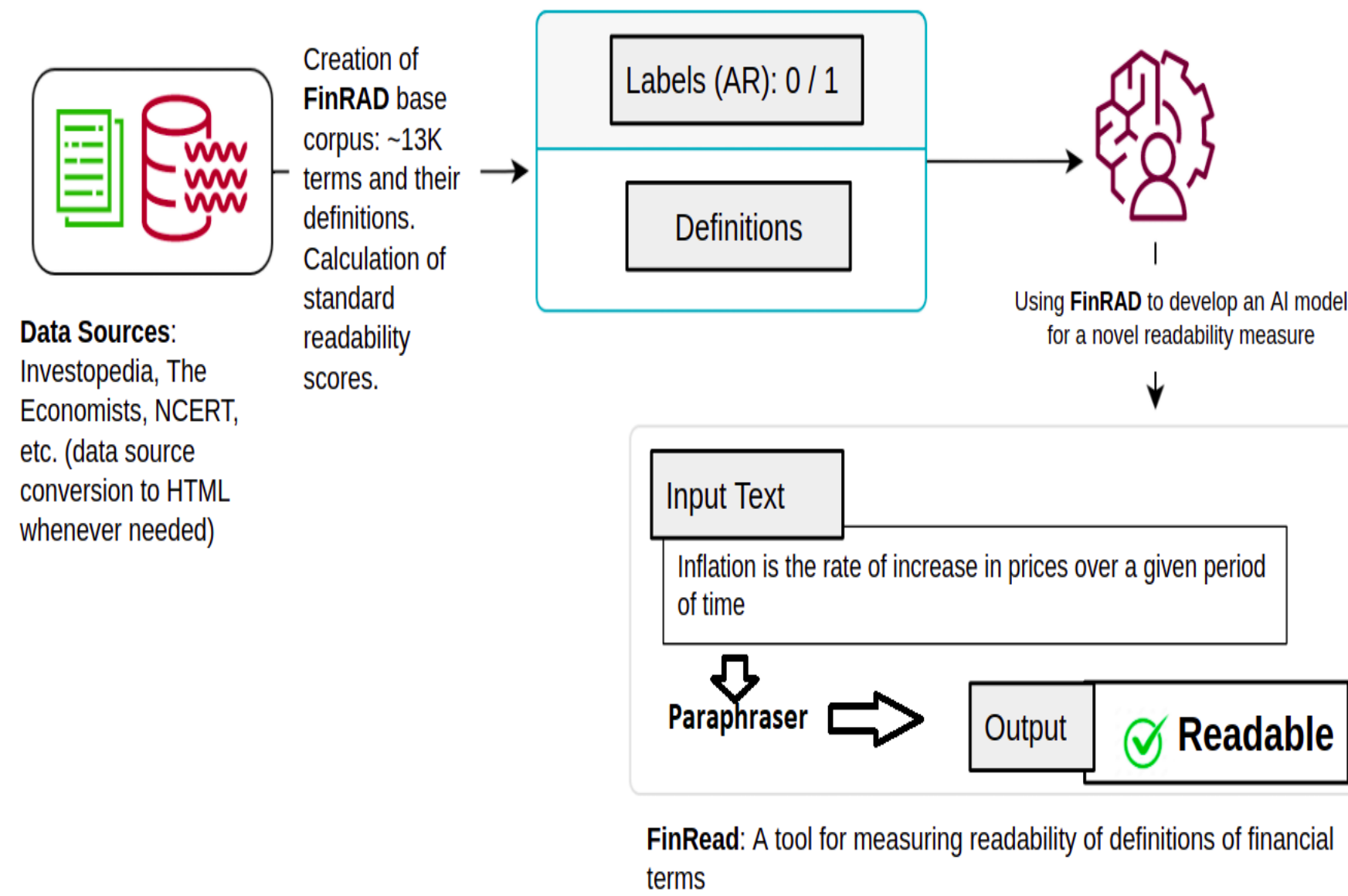


## Summary

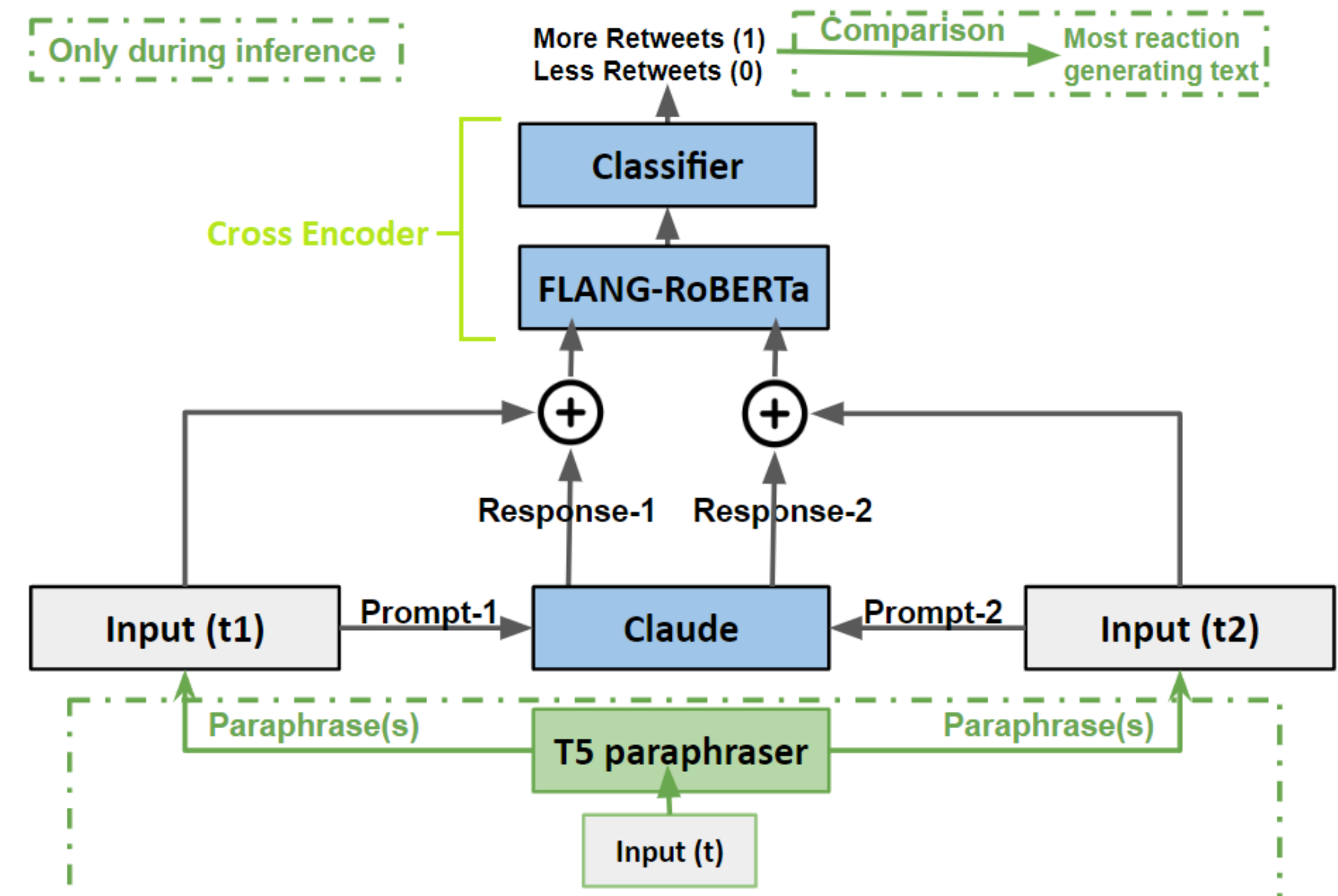
Humans strive for a better quality of life, which is often facilitated by financial stability. However, several obstacles hinder individuals' progress towards financial prosperity, including insufficient financial literacy, escalating wealth inequality, and the proliferation of misleading information on social media. We explore four key areas where Natural Language Processing (NLP) can contribute to enhancing financial literacy, reducing wealth disparities, ensuring a sustainable future, and fostering economic prosperity. These areas are: Inclusive Investing, Enhanced Investing, Impactful (Green) Investing, and Informed Investing. Additionally, we focus on catering specifically to the Indian market (Indic Investing) and provide various resources to improve the comprehensibility of financial texts. Inclusive Investing focuses on increasing the readability and accessibility of financial texts. Improved Investing aims to streamline the investor's journey by offering hypernyms and relationships between entities. Impactful Investing emphasizes sustainable pathways. Informed Investing involves eliminating financial misinformation from social media, such as assessing the credibility of posts by executives and identifying false or exaggerated claims. In most instances, we demonstrate the effectiveness of our methods by comparing them to existing state-of-the-art techniques.

## Inclusive Investing

**Task-1: Given a financial text (FT), we want to assess its readability and simplify it.**

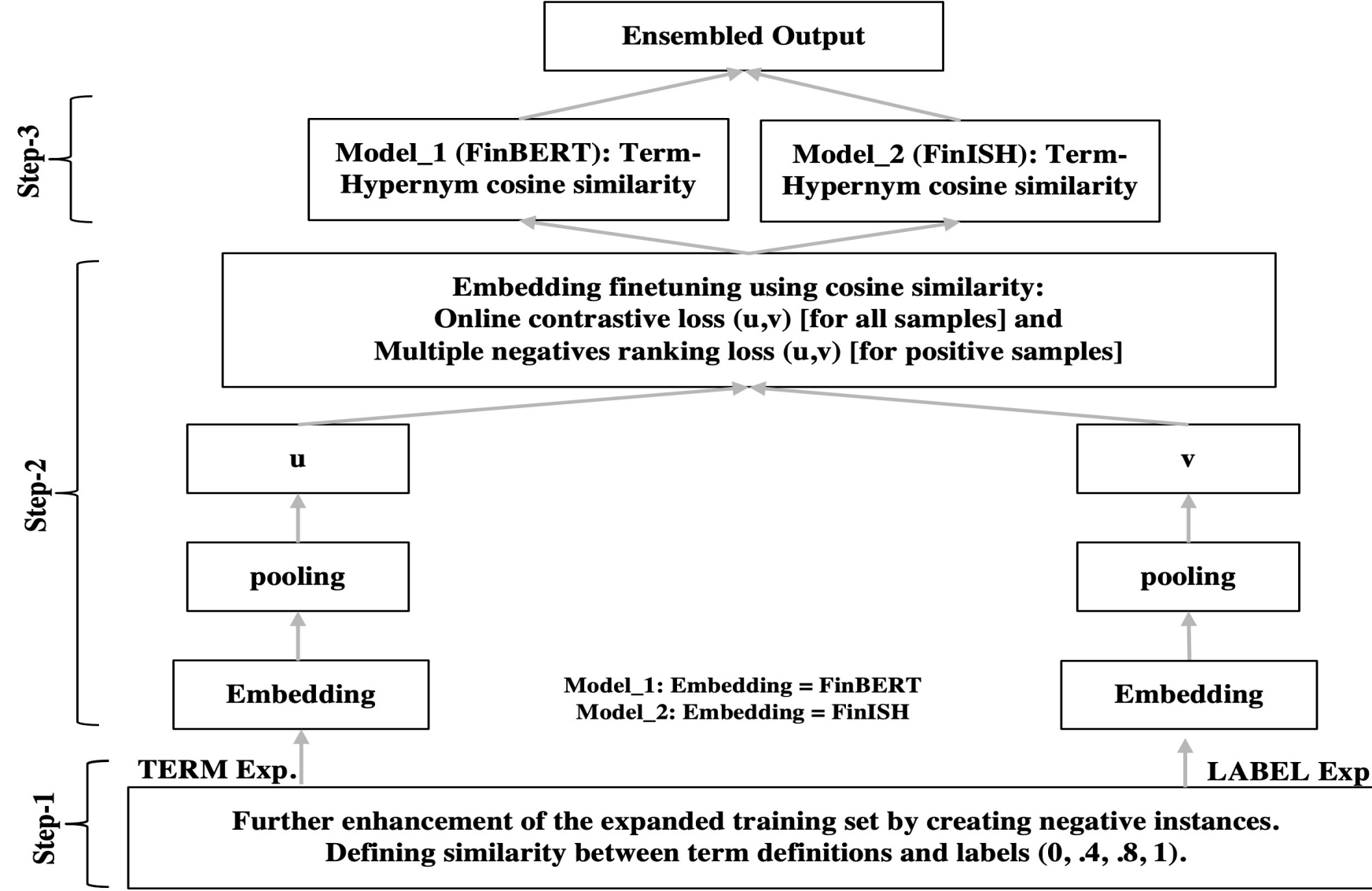


**Task-2: Given two FTs, we want to assess which one would reach more people**

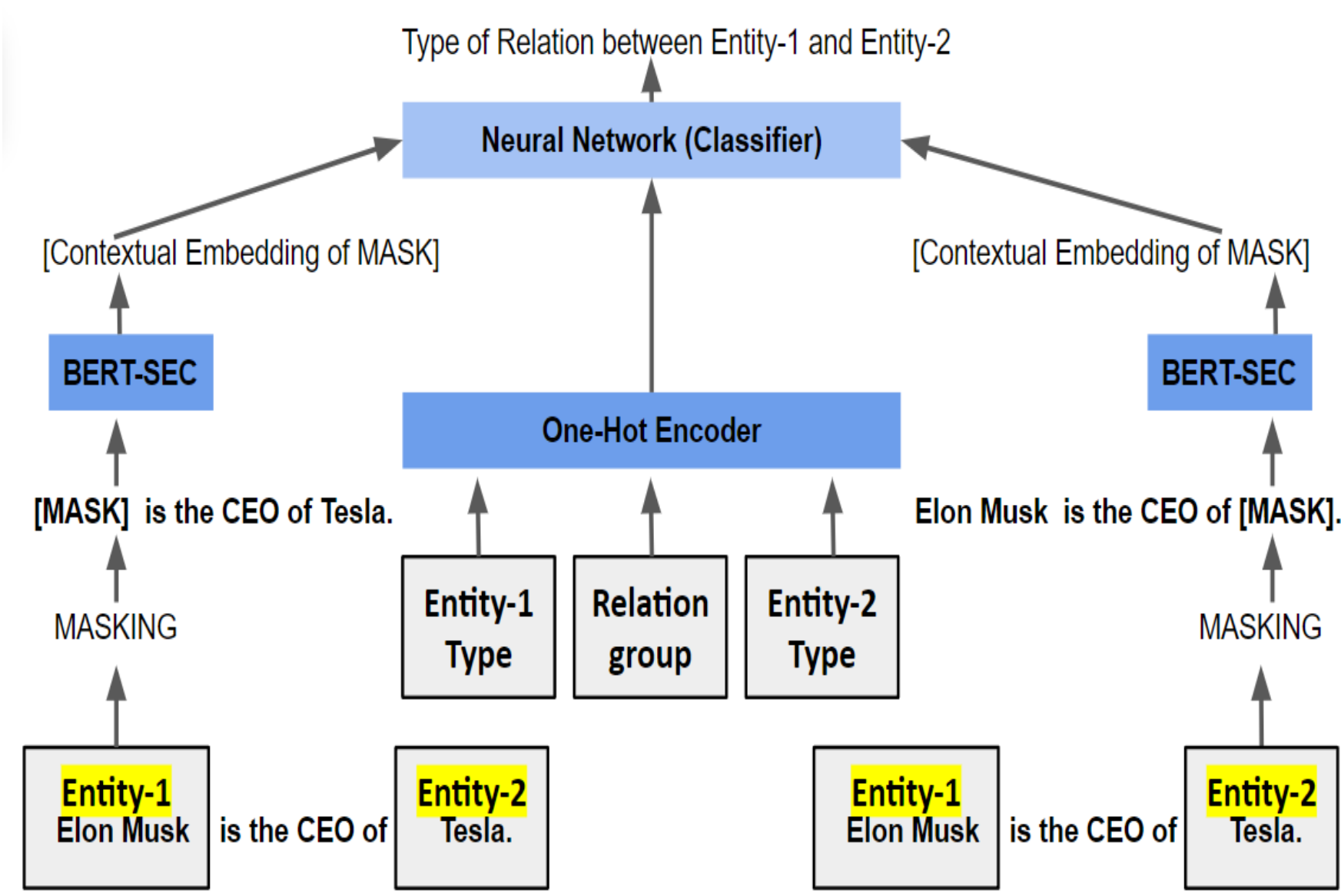


## Improved Investing

**Task-3: Given a financial jargon in a FT, we would like to retrieve its hypernym**



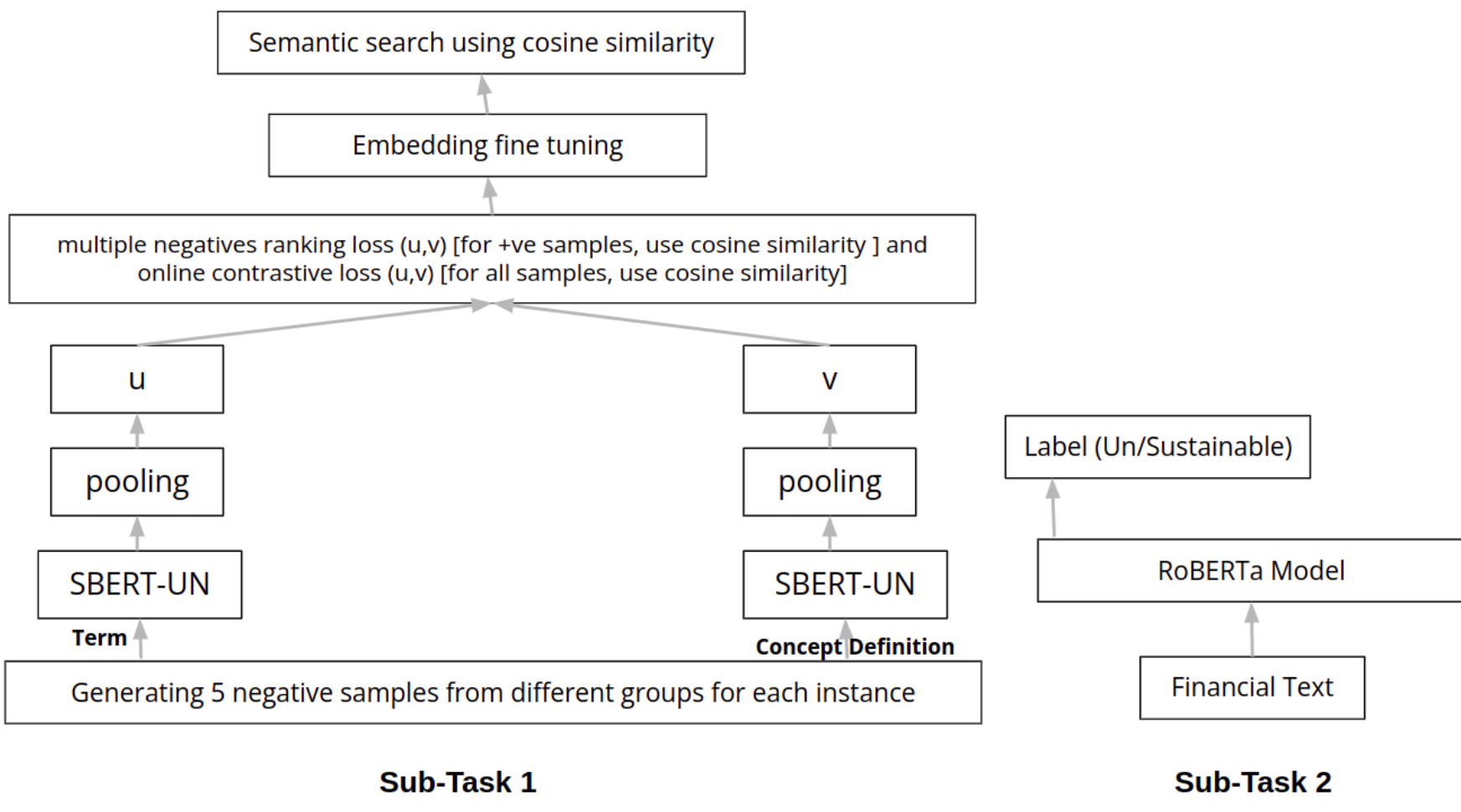
**Task-4: Given two entities in a FT, we would like to determine the relationship between them.**



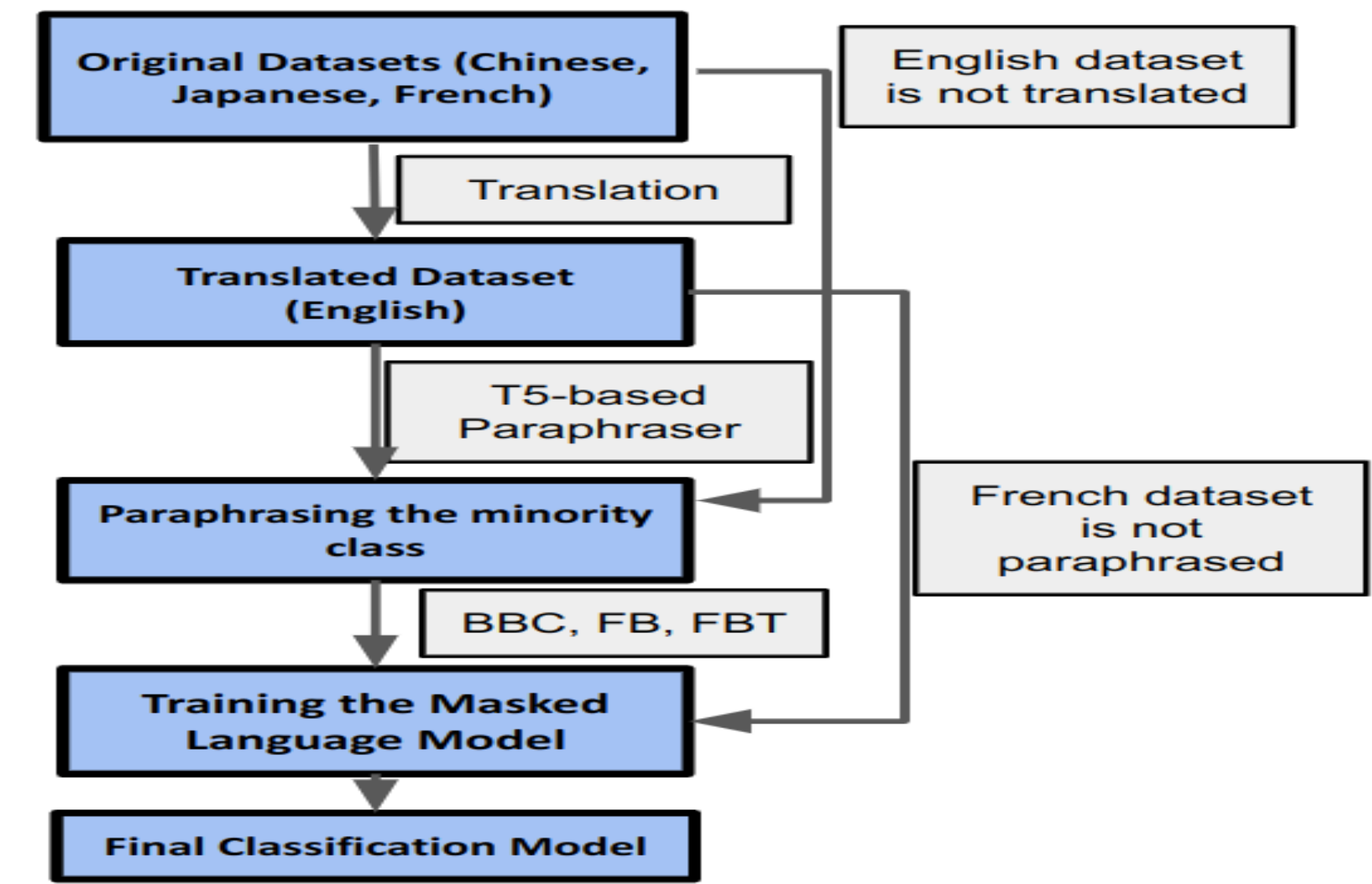
## Impactful Investing

**Task-5: Classify a FT as Sustainable / Unsustainable**

**Task-6: Detect ESG Issues from FTs in English**

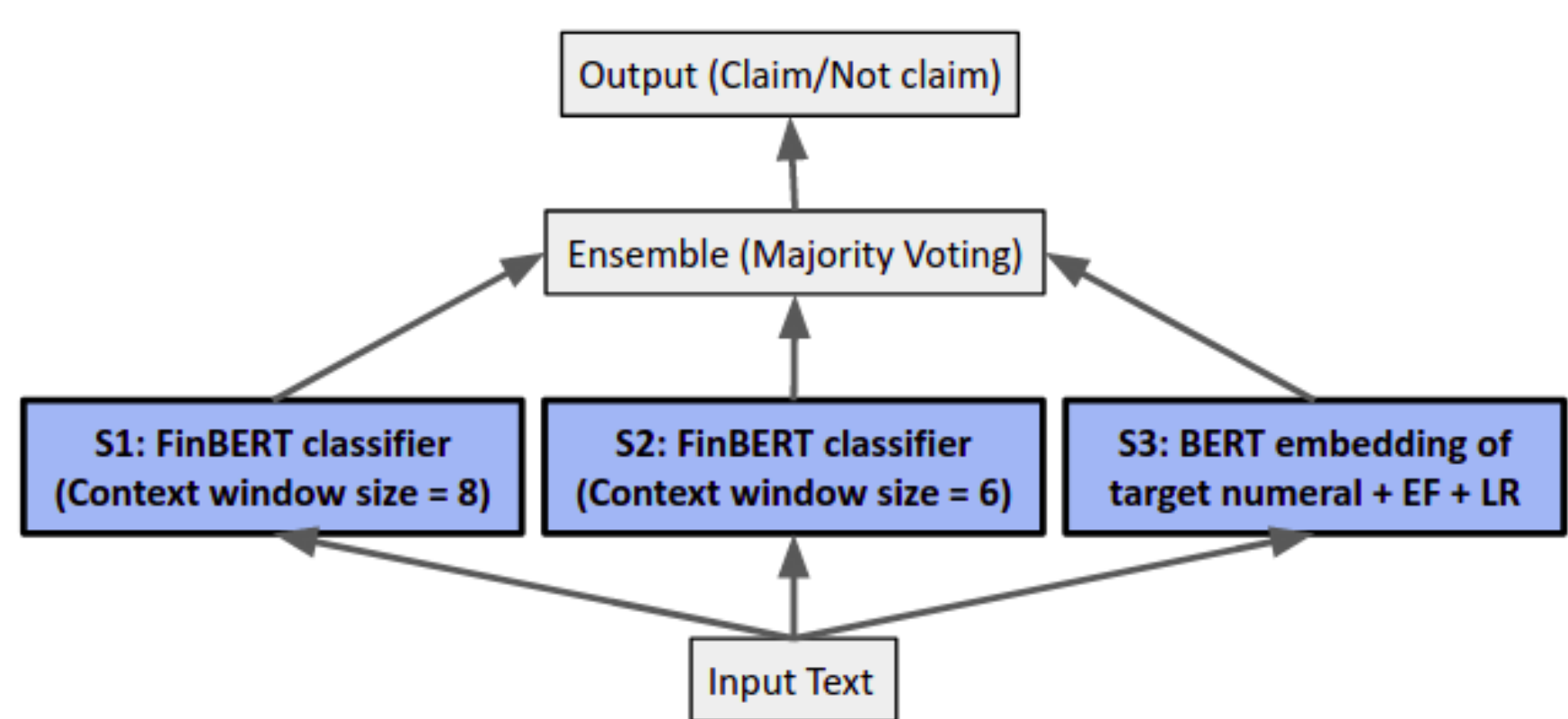


**Task-7: Identify ESG impact type, duration of FTs**

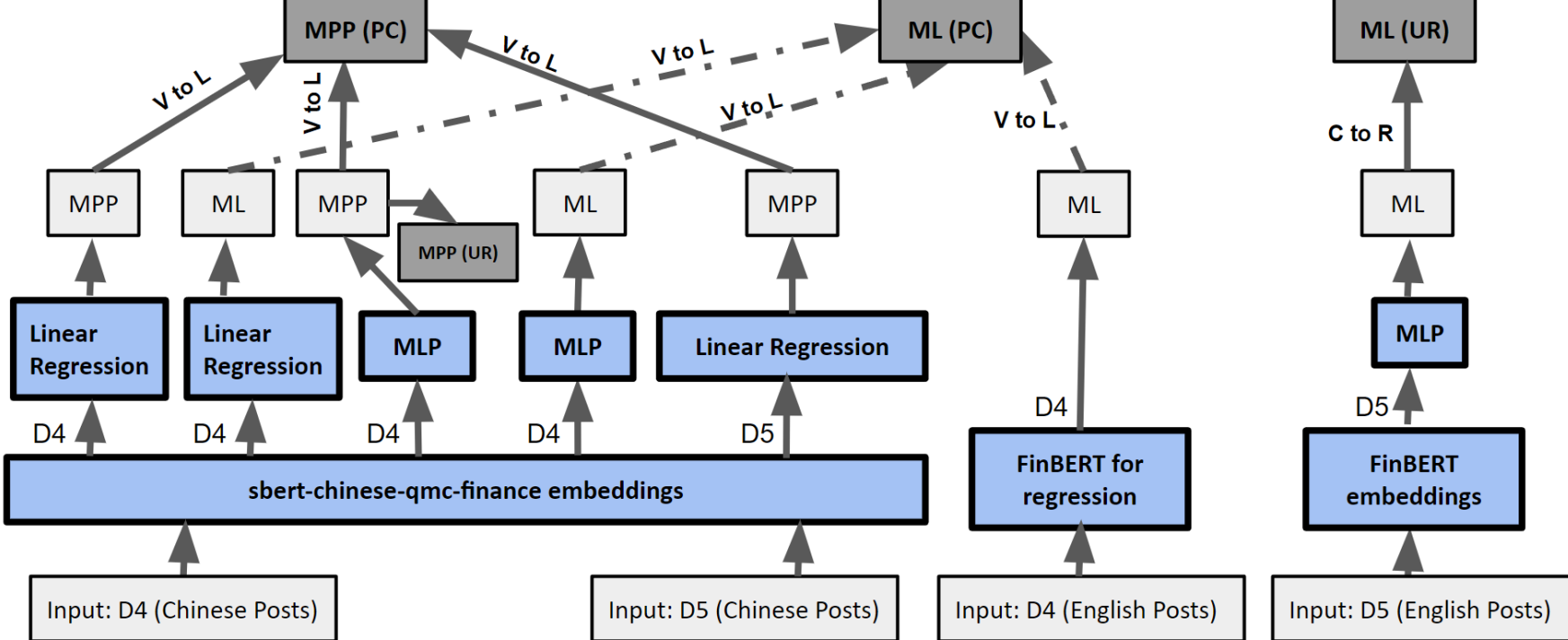


## Informed Investing

**Task-8: Detect exaggerated and in-claim numerals**



**Task-9: Evaluate the Rationals of Amateur Investors**



**Task-10: Evaluate the trustworthiness of Social Media Posts by Executives on Stock Prices**

**Task-11: Fine-grained Argument Understanding**

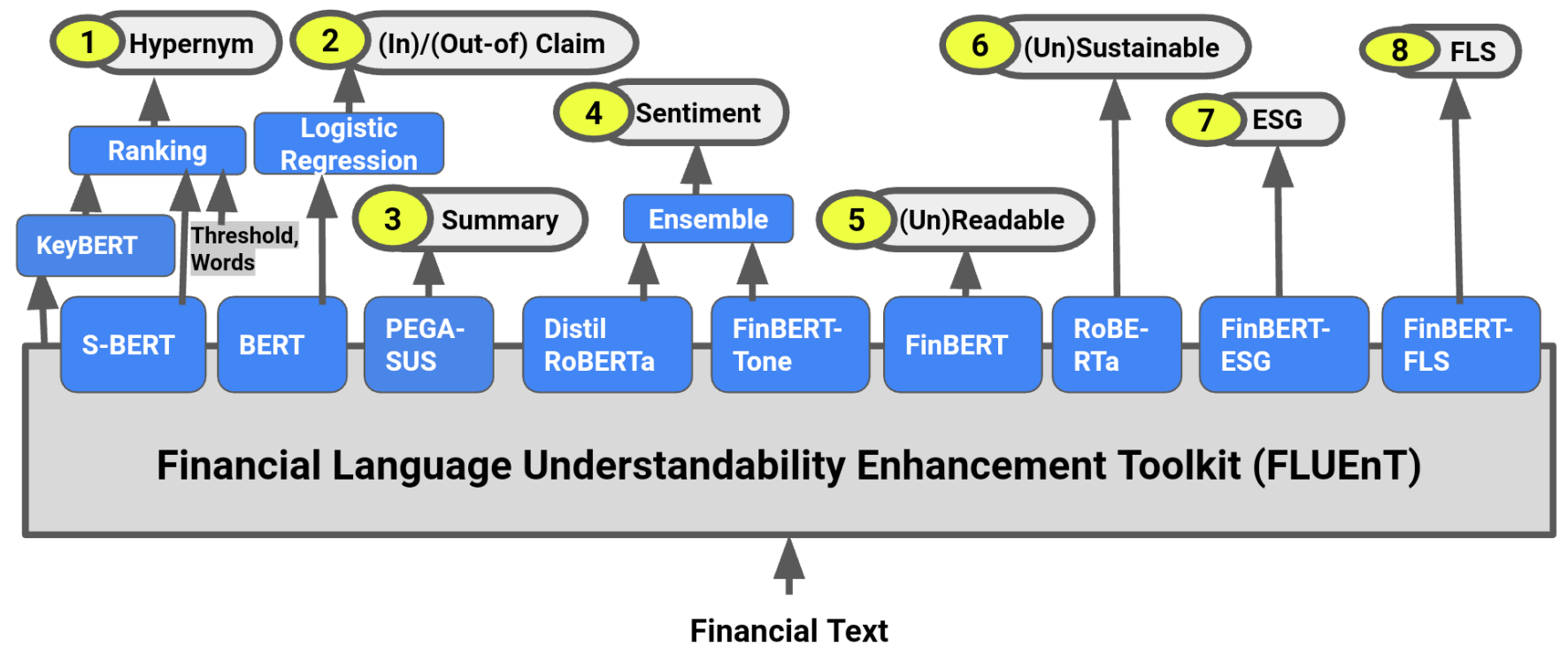
## Indic Investing

**Task-12: Financial Argument Analysis in Bengali**

**Task-13: Extract ESG Issues, Assess Sustainability, and Detect exaggerated numerals from FTs in Hindi, Bengali, & Telugu**

## Tools for FinNLP

**Task-14: Financial Language Understandability Enhancement Toolkit (FLUEnT), ESG Issue Detector (EID), Financial Claim Analysis Tool (FinCAT), etc.**



## Approaches and results for different tasks

AU-ROC = Area under the ROC curve, Acc. = Accuracy, MPP = Maximum Possible Profit, ML = Maximum Loss, MAPE = Mean Absolute Percentage Error, NA = Not Applicable, SOTA = State of the Art, LLM = Large Language Model, PLM = Pre-trained Language Model, Trans-Prp = Translate Paraphrase, IT = Impact Type, ID = Impact Duration

Task #	Metric	Approach Summary	SOTA	Performance	New Data	Language	New Tool
1	AU-ROC	FinBERT finetune	Yes	0.993	Yes	English	Yes
2	F1	RoBERTa + Claude (LLM)	Yes	0.731	Yes	English	No
3	Acc.	SBERT finetune	Yes	0.967	No	English	No
4	F1	SEC-BERT + Neural Network	No	0.736	No	English	No
5	Acc.	RoBERTa finetune	No	0.932	No	English	No
6	F1	SEC-BERT finetune	No	0.715	No	English	Yes
7	F1	FinBERT finetune	No	0.929 (IT)	No	English	No
7	F1	Trans-Prp + FinBERT finetune	No	0.756 (IT)	No	French	No
7	F1	Trans-Prp + FinBERT finetune	Yes	0.679 (IT)	No	Japanese	No
7	F1	Trans-Prp + FinBERT finetune	Yes	0.677 (IT)	No	Chinese	No
7	F1	Trans-Prp + PLM finetune	No	0.5882 (ID)	No	English	No
7	F1	Trans-Prp + PLM finetune	Yes	0.5616 (ID)	No	French	No
8	F1	Ensemble (FinBERT, BERT + Logistic Regression)	No	0.948	No	English	Yes
9	MPP, ML	SBERT Chinese + Classifier, FinBERT	No	0.575 (MPP), 0.598 (ML)	No	Chinese	No
10	MAPE	Gated Recurrent Unit	Yes	0.382	Yes	English	Yes
11	F1	Cross Encoder (FinBERT Finetuned)	No	0.789	No	English	No
11	F1	Translate + Cross Encoder (SEC-BERT)	No	0.641	No	Chinese	No
12	F1	MBERT, Cross Encoder (MBERT)	No	0.721 (1st task), 0.755 (2nd Task)	Yes	Bengali	Yes
13	F1	MBERT+Classifier, Translate + RoBERTa, Translate+MBERT	Yes	0.680 (1st task), 0.950 (2nd task), 0.590 (3rd task)	Yes	Hindi	No
13	F1	MBERT+Classifier, Translate + RoBERTa, Translate+MBERT	Yes	0.650 (1st task), 0.920 (2nd task), 0.550 (3rd task)	Yes	Bengali	No
13	F1	MBERT+Classifier, Translate + RoBERTa, Translate+MBERT	Yes	0.680 (1st task), 0.920 (2nd task), 0.580 (3rd task)	Yes	Telugu	No
14	NA	Gradio (frontend)	NA	NA	NA	Various	Yes

## References

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