

CONTRIBUTIONS

- We have created verb categorisation data for Hindi language.
- We introduce three new verb categorisation approaches.
- We introduce an intuitive rule-based solver that uses verbs to identify specific mathematical operations to solve word problems.

VERB CATEGORISATION DATA

VERB CATEGORIES

- **Observation:** It states just the presence of entities in a container.
- **Positive:** It states the quantity of entities being added to a container or which are created in a container.
- **Negative:** It states the quantity of entities being removed or destroyed from a container.
- **Positive Transfer:** It is associated with statements that involve two containers. It states a transfer of the quantity of entities from second container to the first.
- **Negative Transfer:** It is associated with statements that involve two containers. It states a transfer of the quantity of entities from first container to the second.

- In the HAWP dataset (2336 word problems), **1713 word problems** are based on **addition and subtraction** operations.
- In these 1713 word problems, there are around **200 unique verbs**. These verbs were annotated with the categories mentioned above.

VERB CATEGORISATION APPROACHES

I. VERB DISTANCE

- Each verb in Hindi is represented by its pre-trained FastText word vector of 300 dimensions.
- A test verb is assigned the verb category corresponding to its closest training verb. We implemented this approach using **1-nearest neighbor approach**.

II. STATISTICAL METHODS

- Bag of words representation for a verb and its neighbours in their actual order as a sample and the category of the verb as the label.
- We created samples for the task using word-level information (POS and dependency tags) with the context

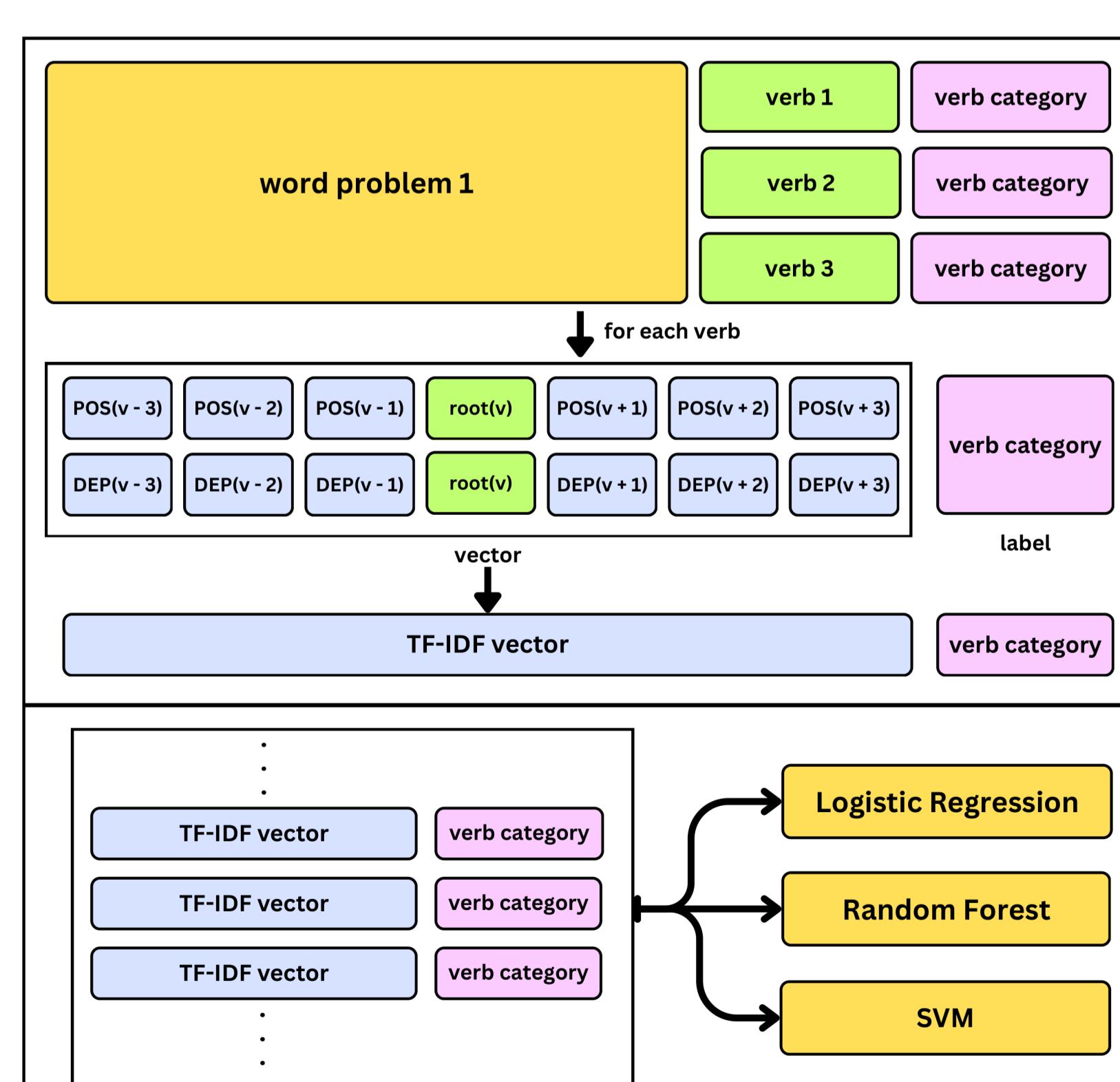


Figure 1: Training Statistical Models

window size as 7, as indicated in Figure 1.

- We performed this classification task using 3 machine learning approaches: Logistic Regression, Random Forest and Support Vector Machines (SVM).

III. MuRIL

- For this task, all the words till a verb is encountered constitute a sample. A total of 6506 samples were created for verb categorization.
- MuRIL is fine-tuned for ten epochs with a batch size of 4.

RESULTS

- We used **5-fold cross validation** technique to evaluate the models

Metric	F1-score
Verb Distance	0.895
Linear Regression	0.865
Random Forest	0.883
Support Vector Machines	0.904
MuRIL Fine-tuning	0.962

RULE BASED SOLVER EXAMPLE

shon ke paas 13 blok the. mildred ke paas 84 blok the. mildred ne shon ko 2 blok die. mildred ke paas kitane blok bache?
Gloss: Shawn had 13 blocks. Mildred had 84 blocks. Mildred gave 2 blocks to Shawn. How many blocks does Mildred have left?

