Google Hackathon : Build for India

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Tried 2 Tasks

- Task 1 - Build ML models to categorize waste items from an image captured using a mobile phone.
  - Categorization involves separating waste into wet-waste **(food), and dry-waste (recyclables)**
  - This is sub-categorized into **paper, cans, plastics and others.**
- Task 2 - Build a model for classifying farmer's query into one of the pre-defined categories.
  - The training data contains farmers' query and a category label.

Task 1 - Classify waste category from images

Exercise for all

Predict the Category

Answers

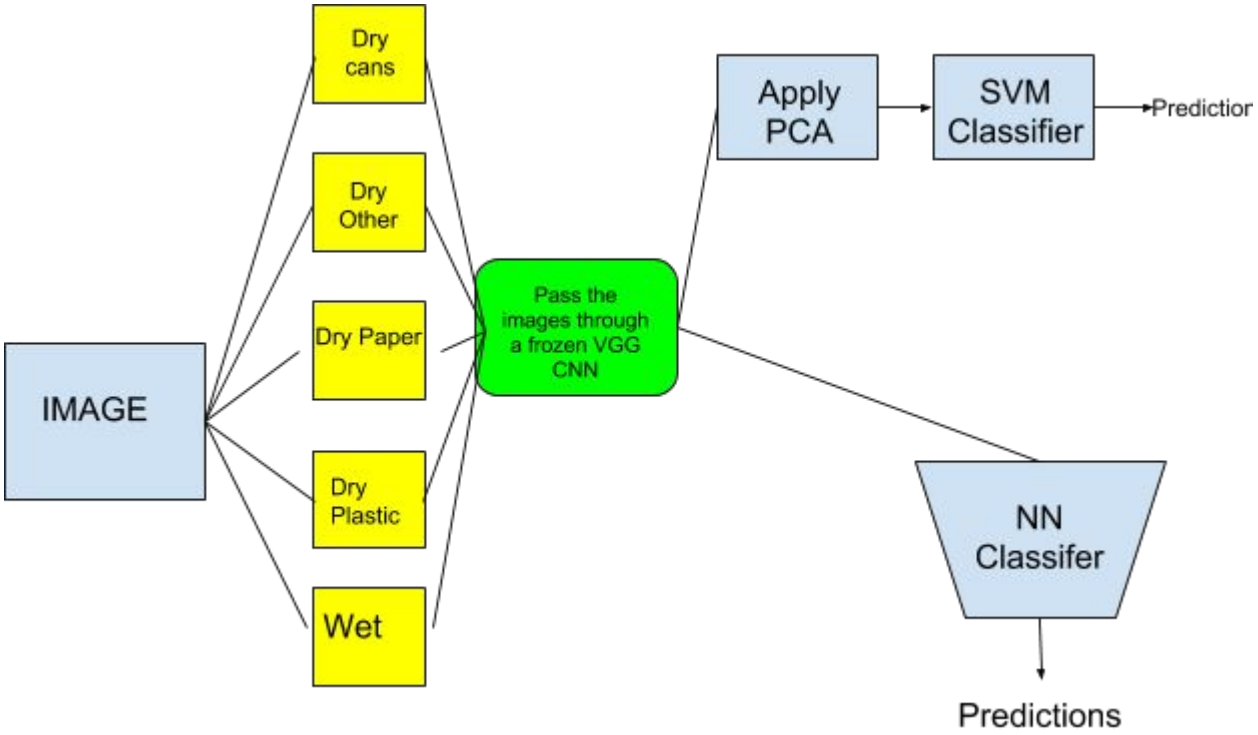
Dry plastic

Dry paper

Dry can

Dry other

PIPELINE


Dry cans
Dry Other
Dry Paper
Dry Plastic
Wet
IMAGE
Pass the images through a frozen VGG CNN
Apply PCA
SVM Classifier
Predictior
NN Classifer
Predictions

How to proceed forward ?

STEPS-

- Dataset - Images for each category
- The images obtained are of different dimensions so each image has to scaled to a uniform 224x224 size
- After getting the images, each image which is a 2-D matrix of size 224x224 is passed through a pre-trained CNN (convolutional neural net)
- The features are extracted for each movie poster from the pre-trained CNN.

Steps continued

- The dimensions of the extracted features is reduced using Kernel PCA method.
- The extracted features after reduced dimensions are sampled into training and testing sets.
- The training set is used to train a SVM(support vector machine) or a Neural Network.
- The testing set is then used to predict the category of the waste item and the accuracy of the prediction is calculated.

Detailed Approach - 1. Extracting Images

Waste Categories

- Dry_other - 0
- Dry_cans - 1
- Dry_plastic - 2
- Dry_paper - 3
- Wet - 4

2. Preprocessing and Extracting CNN Features

- The images downloaded from are of various sizes in the range of (300x400). Before processing the data further each poster was resized to 224x224.
- Each poster is a 2-D matrix of size 224x224 which is then passed through a pre-trained CNN (VGG16 in this case) and a 1-D vector of size 4096 is obtained.

Why VGG16 ?

- Recent studies have shown that generic image descriptors extracted from CNNs are powerful when used in combination with SVM or softmax classifiers in visual recognition tasks.
- Choosing a neural network trained on ImageNet is suitable since it covers a large variety of images from a large database.

3. Reducing the dimensions of the feature vectors

- KERNEL PCA to the rescue.
- Each 4096 dimensional feature vector was reduced to a 100 dimensional vector after Principle Component Analysis.

4. What we get from PCA ?

Applying Kernel PCA on the 4096 dimensional vectors gives us reduced dimensional vectors for each image.

5. Classifying using SVM & NN

- The dataset is divided into 80% training images and 20% validation.
- The reduced vectors are used to train a SVM or a NN.
- After training the testing is done and accuracy is obtained.
- For this the scikit-learn python library is used.

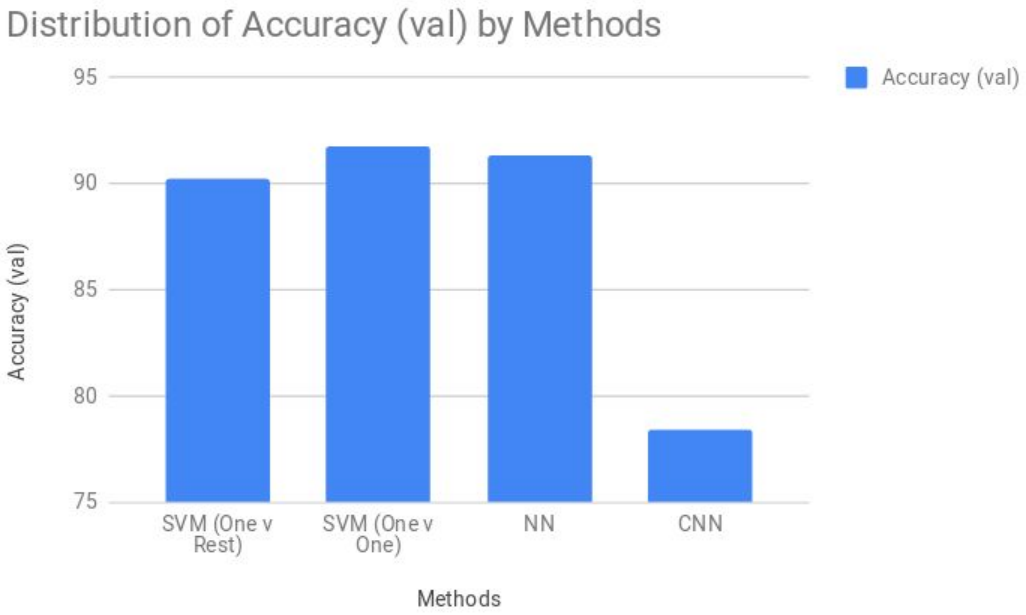
6. Experiments with Small CNN

- We tried a few experiments with a shallow CNN.
- But that did not give very convincing results due to lack of data

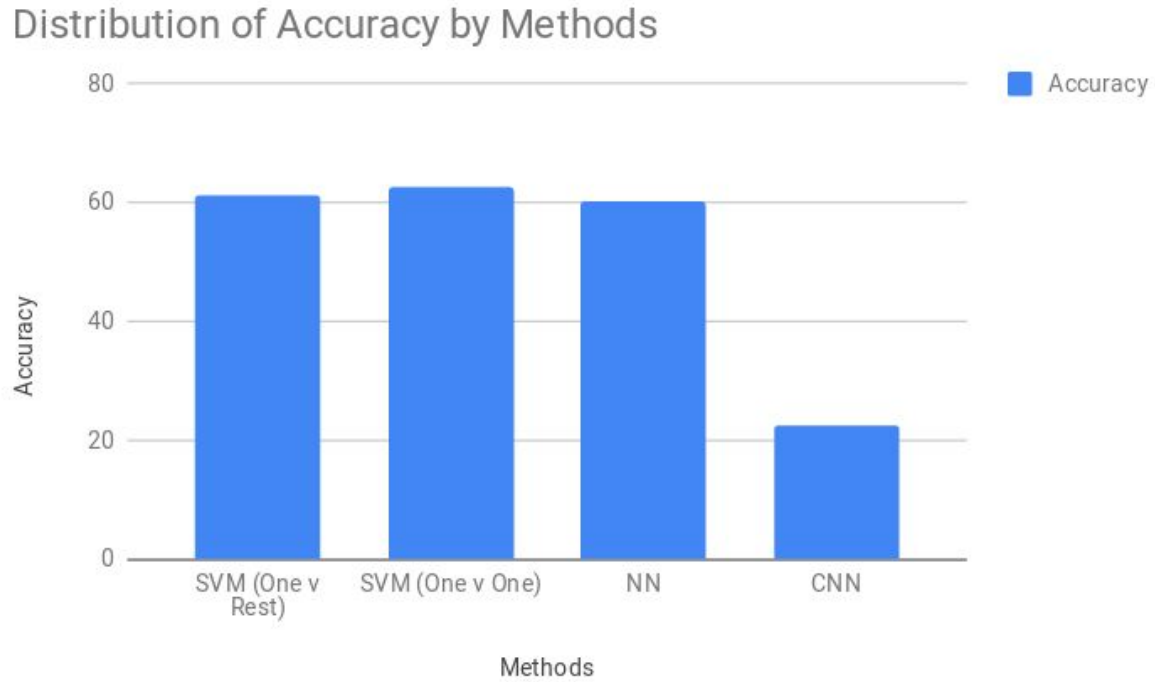
Results

Method	Accuracy (Test)	Accuracy(Validation)
SVM (One vs Rest)	61.4	90.2
SVM (One vs One)	**62.25**	**91.8**
NN	60.34	91.3
CNN	22.45	78.4

Results - Validation



Results - Test on 30% data



Improvements

- Train on more data and get results for the same.
- Train machines to do classification/prediction using CNNs (after data augmentation.
- Try to do object detection, then train on those detected bounding boxes.

Leaderboard Results

Task 1: Classify waste category from images

Accuracy (on 30% test data): 0.62650

Leaderboard Rank: 2

Best (Rank 1): 0.67771

Task 2: Text Classification

Problem Statement

Query: Farmer’s query

Classify:

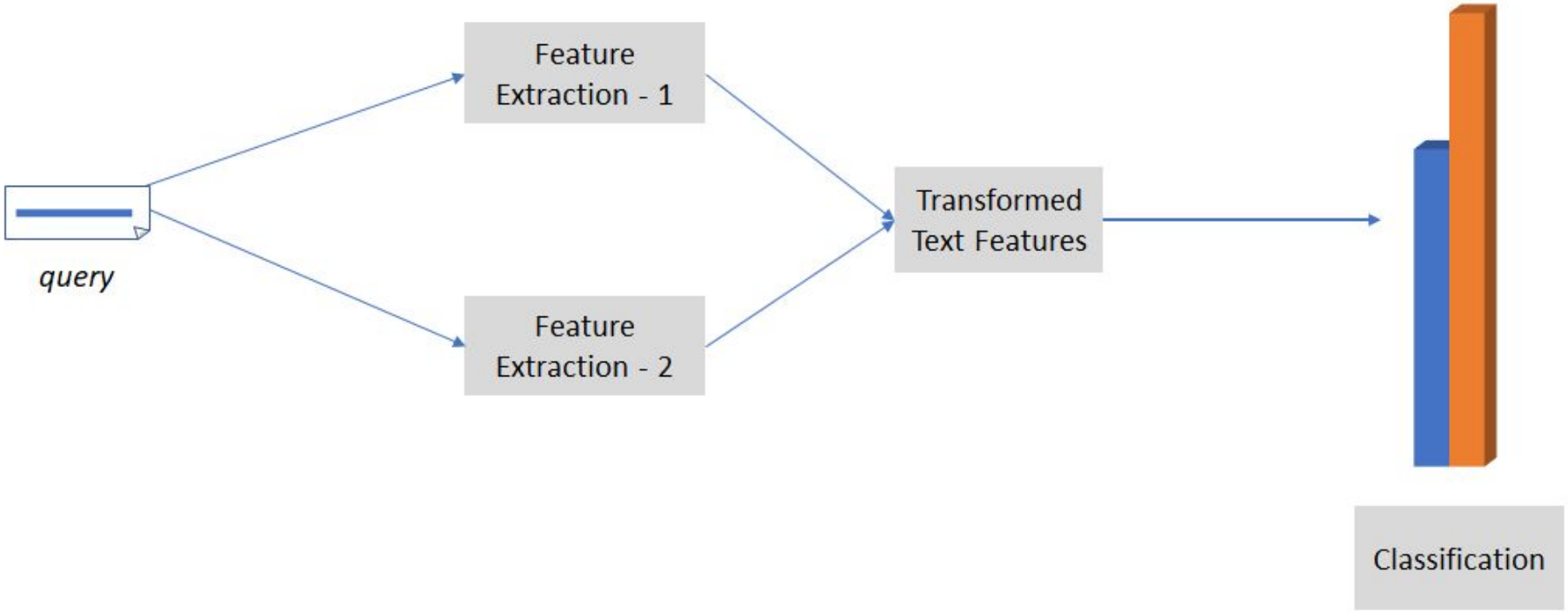
1 - Fertilizer Use and Availability
2 - Field Preparation
3 - Government Schemes
4 - Market Information
5 - Nutrient Management
6 - Plant Protection
7 - Varieties
8 - Weather
9 - Weed Management
10 - Cultural Practices

- plant protection in bengal crop ? ⇒ Plant Protection
- mujhe medicinal crop leni hai kisse sampark kare ⇒ Cultural Practices

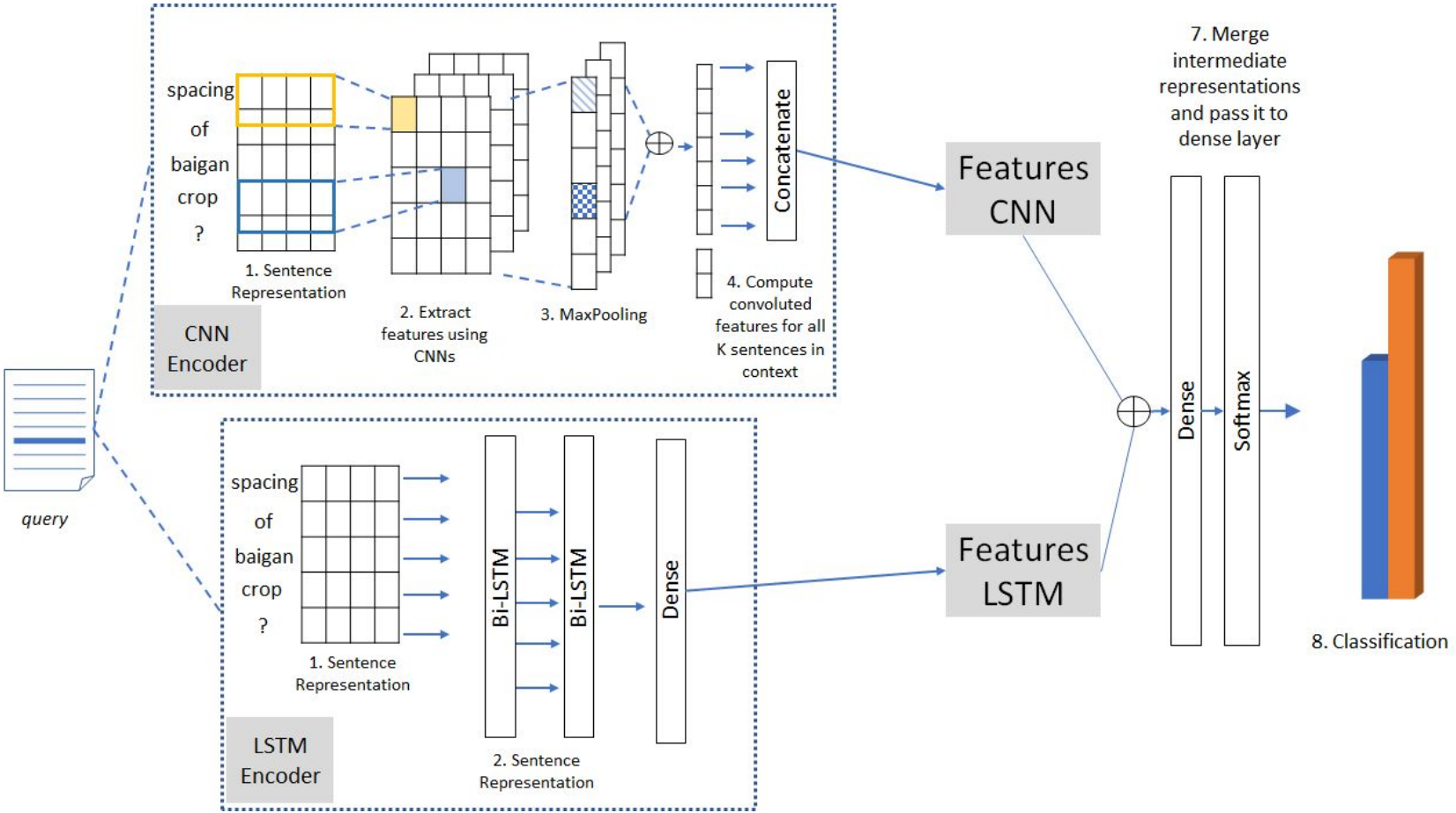
Pre processing Steps

- Punctuation Removal
- Stop Words Removal
- Stemming (Did not work)
- Lemmatization (Did not work)
- Tokenization

Conceptual model architecture



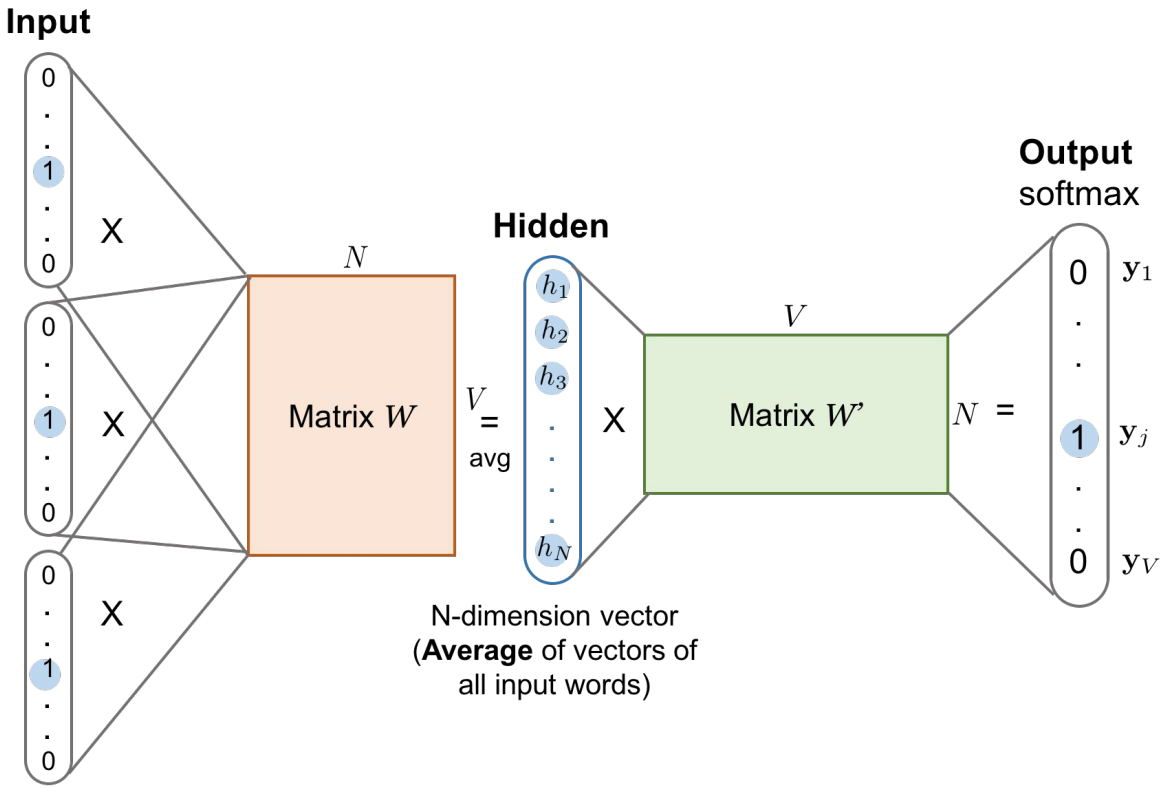
Detailed Architecture Diagram



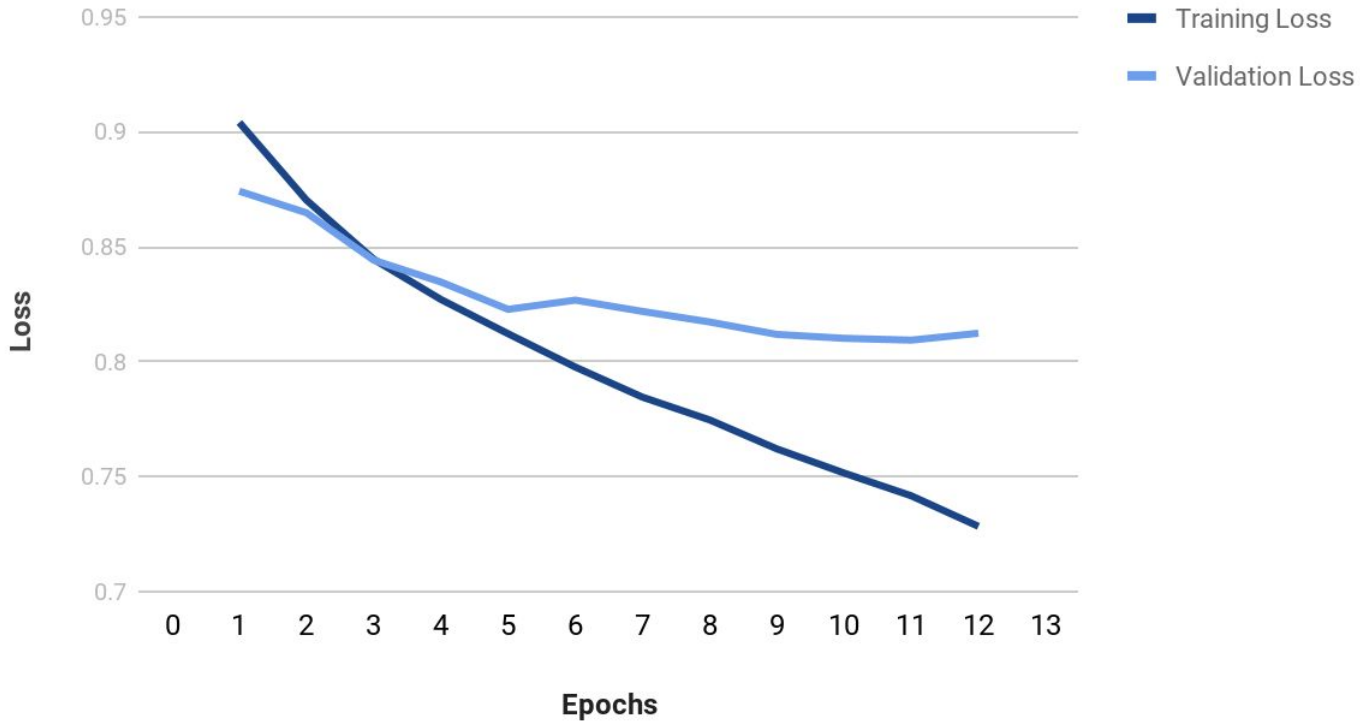
How to handle transliterated text ?

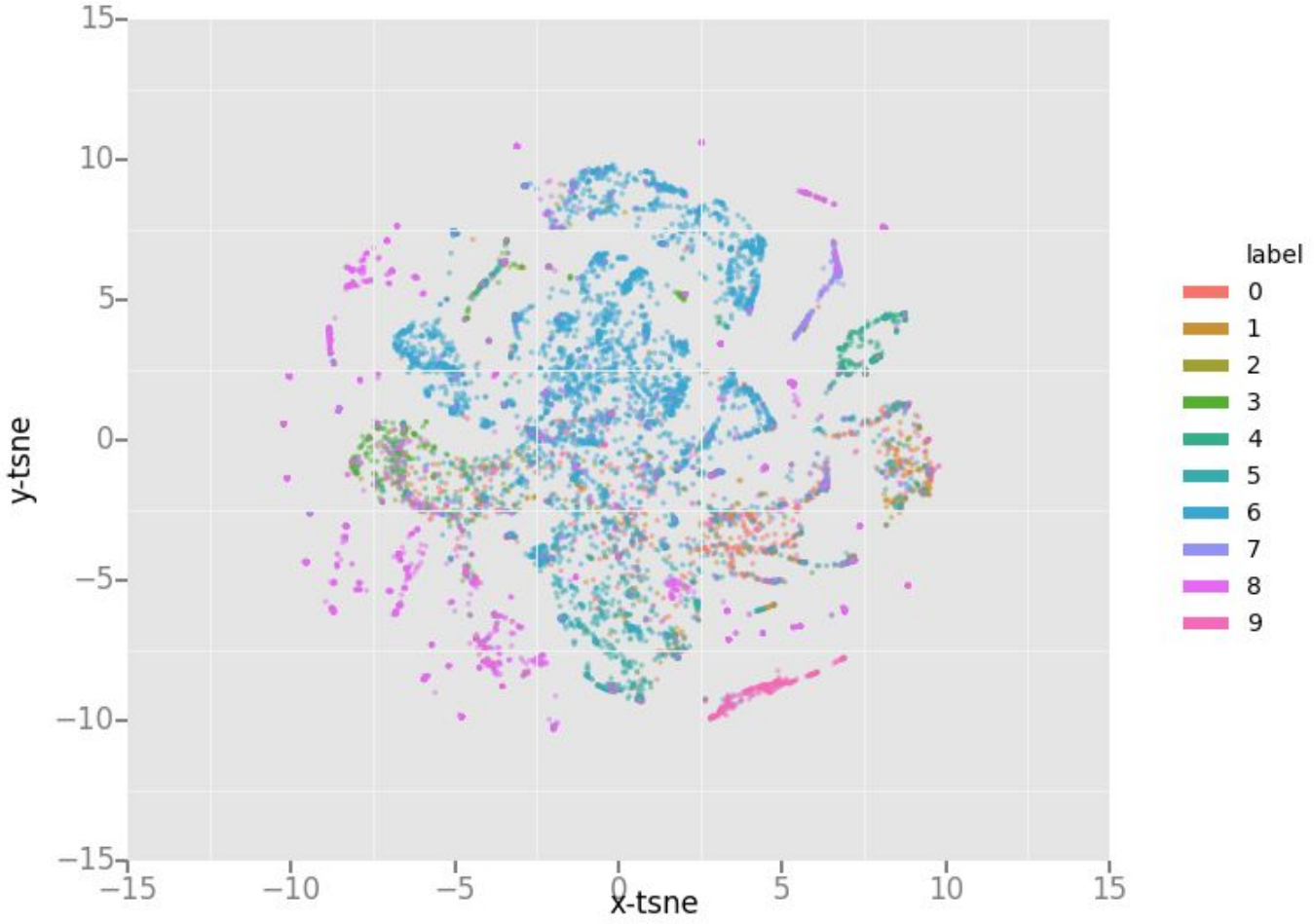
hume apne yaha boring karana hai kaha se karaye kase karaye?

Learning word representations for Hindi-English!



Loss w.r.t. epochs




tSNE dimensions colored by Digit
15
10
5
0
−5
−10
−15
y-tsne
−15
−10
−5
0
5
10
15
x-tsne
label
0
1
2
3
4
5
6
7
8
9

Things we tried but did not work!

- Attention on input sentence
- CNN/LSTM architecture
- Word2vec vectors for words (pretrained on English only)
- Stemming!
- Lemmatization!

Things we almost tried!

- Google Translate API
- Character ngram-based architectures
- Semi-supervised techniques

Leaderboard Results

Task 2: Query Classification

Accuracy (on 30% test data): 0.82366

Leaderboard Rank: 3

Best (Rank 1): 0.83052