Two Important Models in Closed Domain Question Answer Chatbot

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Two Models for Closed domain chatbots

Closed Domain Chatbots

- Designed to chat about a specific topic
- Expect for accurate answers
- Target for specific customers and economic values

Question Answering Model

- Responsible for providing accurate answers

Emotion Detection Model

- Detect customers emotion change
- Decide when people customer support will involve

Question answering model

Baseline Model

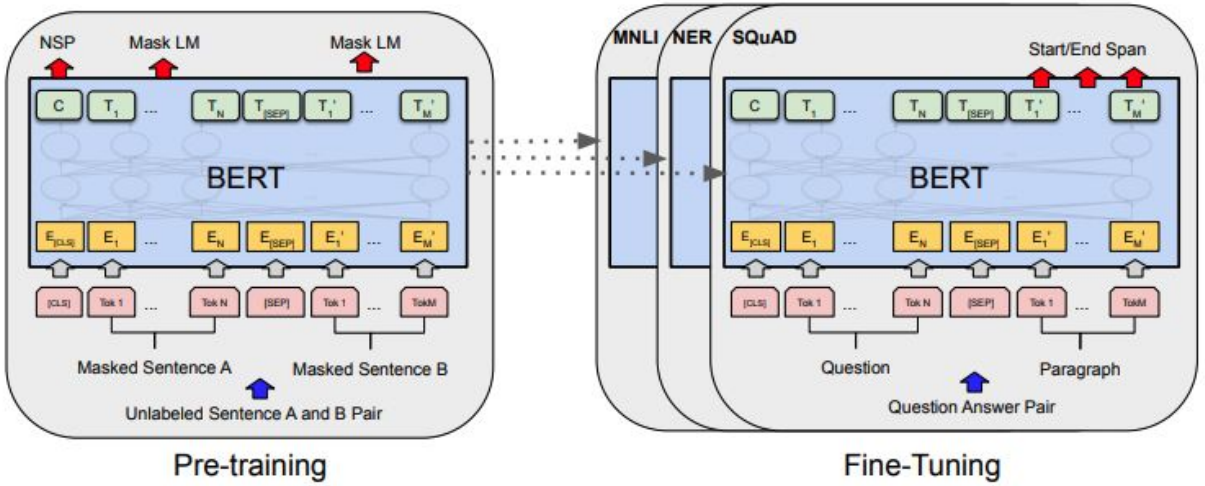
- DISTILBERT - distilbert-base-uncased

Dataset

- SQuAD 2.0

Metrics

- EM
- F1



Improvements

Type I Improvements

- Use model with more trainable parameters
  - ALBERT - albert-base-v2
- Use model with better training target, suitable for start and end span answer task
  - SpanBERT - SpanBERT/spanbert-large-cased

Type II Improvements

- Use ensemble model
  - Skim-Read Model
  - Elbow Method

Highlight

Skim-Read Model

- Skim Part
  - Predict if a question is answerable
- Read Part
  - Predict start and end span of an answer in the text

RESULTS

SQuAD2.0
The Stanford Question Answering Dataset

Model	Model Type	Improvement Type	EM	F1
DISTILBERT distilbert-base-uncased	Discriminative Model	Baseline	64.9457	68.3097
ALBERT albert-base-v2	Discriminative Model	Improved Type 1	78.2111	81.2822
SpanBERT SpanBERT/spanbert-large-cased	Discriminative Model	Improved Type 1	83.1382	86.3032
T5 t5-small	Generative Model	Improved Type 1	N/A	N/A

RESULTS

SQuAD2.0
The Stanford Question Answering Dataset

Skim-Read Model David-Tong/squad2-skim-read-predictor Skim Model Logistic Regression	Ensemble Model	Improved Type 2	83.381	86.519
Skim-Read Model David-Tong/squad2-skim-read-predictor Elbow Method	Ensemble Model	Improved Type 2	84.0984	87.0521

Emotion detection model

Baseline Model

- 1-stage classification model

Dataset

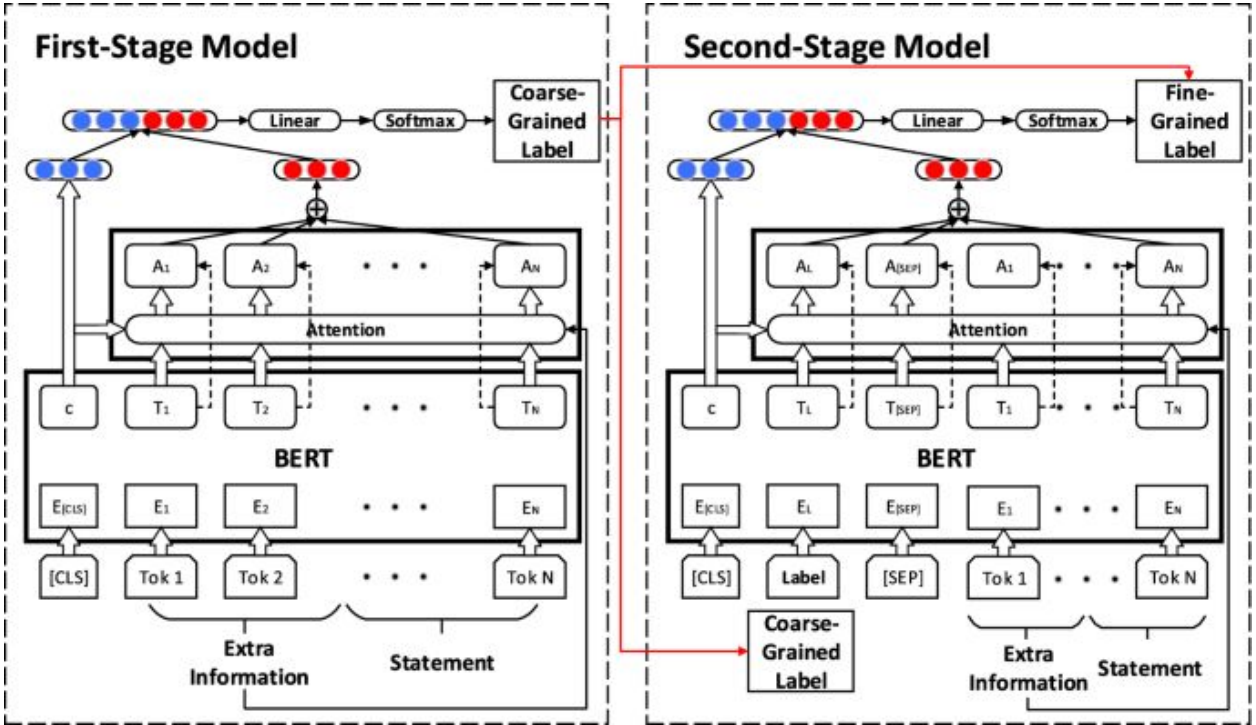
- GoEmotions

Metrics

- Accuracy
- Macro Avg
- Weighted Avg

Improvements

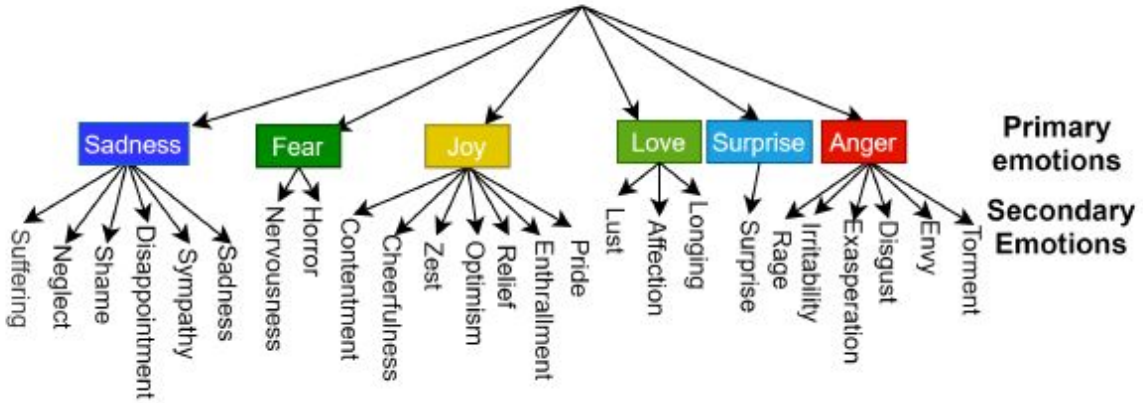
2-Stage Classification Model



Improvements

Type I Improvement

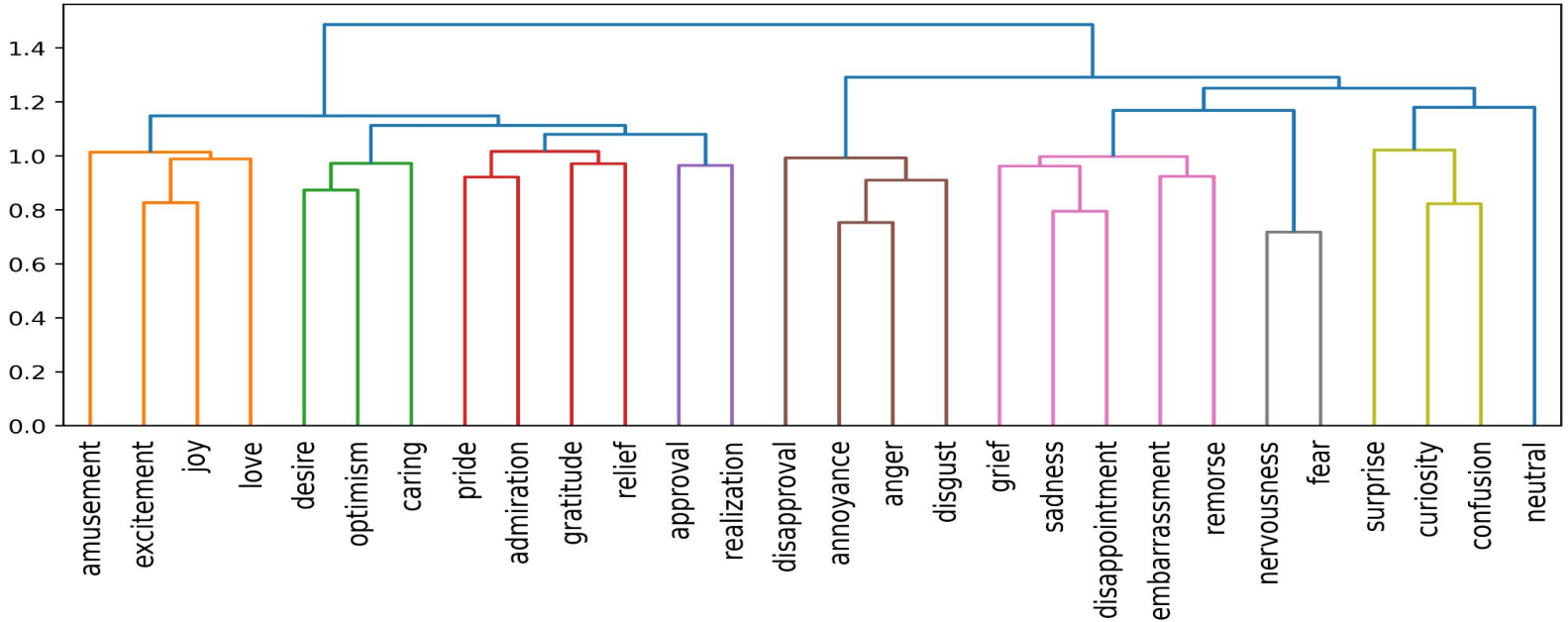
- 2-stage classification using Parrot’s emotion model



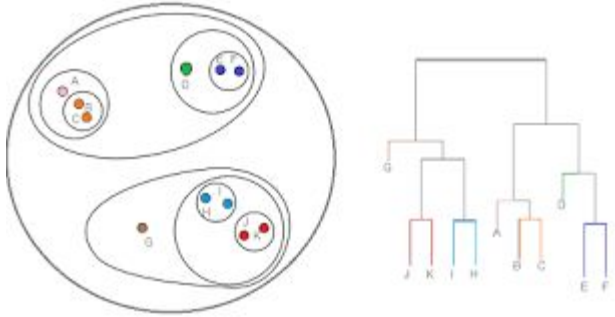
Improvements

Type II Improvement

- 2-stage classification using emotion clustering model



HIGHLIGHT



Emotion Clustering

- Logic behind data
  - Use the text with multiple labels to calculate linkages among emotions
  - Multiple emotions labeled for the same text indicate a close relationship among them.
- Hierarchical Clustering
  - 58009 samples transposed to be 58009 features of an emotion
  - Use correlation to measure similarity between two emotions
  - Use distance of 1.05 as threshold to group emotions

RESULTS

Two-Stage classification doesn’t bring improvement in performance but even a little downgrade in performance.

Data based clustering has a different model from psychological emotion classification model.

RESULTS

Model		F1		
		accuracy	macro avg	weighted avg
One-Stage Classification bert-base-cased	Baseline	0.60	0.49	0.59
Two-Stage Classification (Parrott's Emotions model)	Improved Type 1	0.57	0.48	0.57
Two-Stage Classification (Data Clustering Modell)	Improved Type 2	0.58	0.45	0.57

Look forward

Question Answering Model

- Use generative models like GPT or T5

Emotion Detection Model

- Remove neutral labeled data, focus on emotion and classification
- Use other clustering method and compare clustering results with existing psychological classification models
- Cast emotions to a 2D plane and watch relationships among them.