

Predicting the Popularity of Reddit Memes with Deep Learning

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19th January 2022

Introduction

- Media in 21st century, internet's role
- From jokes to memes
- Motivation: predict popularity for marketing
- Short-term goals: acquire data, use CNNs and ViT models

Background

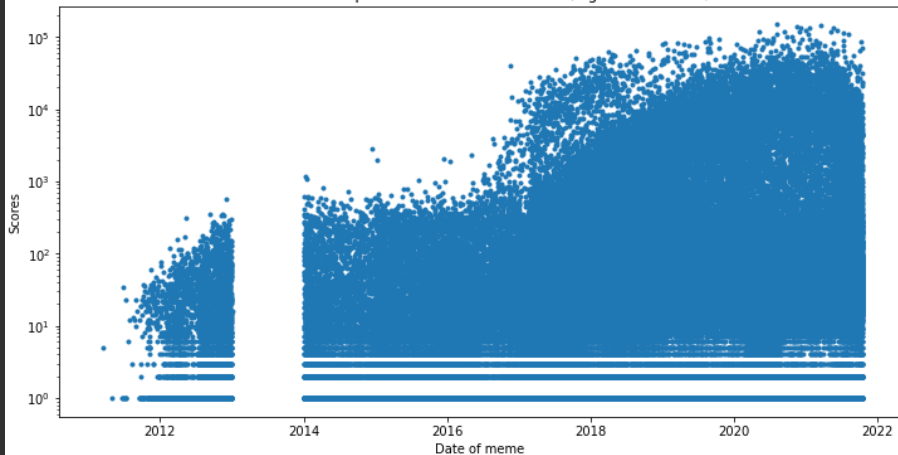
- Fairly new phenomenon, viral marketing research
- On topic: Juhász Péter masters thesis was our base
- Fair result of 0.67 ROC-AUC but in a 14-month period
- New functionality, new architecture, new target variable etc.

The data

- Dataset: memes scraped from Reddit
- 258 thousand images between 2011 and 2021
- Storing id, title, score, date, metadata
- Target variable: top 5 percentile of weekly rolling window

Exploratory analysis

Scores of scraped memes 2011 and 2021 (logarithmic scale)



The plan

1. Splitting the dataset into train-valid-test folders with 0/1 subfolders
2. Data Cleaning
 - 2.1 Converting non-RGBA pics into RGB format
 - 2.2 Removing GIFs, pics exceeding PIL's resolution limit
 - 2.3 Removing pics that cannot be decoded by TF
3. Using transfer learning to train various CNN and ViT models using weighting because of the class imbalance
4. Evaluating the models on the test set with several metrics

Training (1)

Architecture:

- CNN models trained in TF
- ViT models trained in both TF and PyTorch

Model Training:

- Balanced Class Weighting: $w_i = n_train / (n_classes \times n_train_i)$
- Data augmentation
- Top layer(s) are custom Dense layers, others are transferred.
- Output Layer: A single neuron with sigmoid activation
- Loss: Binary Crossentropy
- Training first with frozen transferred layers then fine-tuning by unfreezing some top layers
- Optimization: Adam with early stopping and learning rate reduction

Training (2)

Difficulties and solutions:

- Class Imbalance
 - Using different class weighting
 - Oversampling
 - Undersampling
 - Several SMOTE techniques
- Slow training
 - More GPU power
 - More resource optimisation
- Hyperparameter optimisation

Results

Model	Accuracy	Precision	Recall	F1-score	PR-AUC
ResNet	0.6540	0.0815	0.6042	0.1436	0.0913
ResNet w/ fine-tuning	0.8996	0.1124	0.1583	0.1315	0.0882
Xception	0.8092	0.0839	0.3000	0.1311	0.0832
ViT B32	0.6064	0.0740	0.6250	0.1323	0.0929
Google ViT w/ fine-tuning	0.8803	0.1106	0.2208	0.1474	0.1021

Table: Different scores on the test dataset

Summary and Outlook

- An enormous amount of Reddit Memes scraped and processed.
- Managed to build quite good (60-100% better than random) CNN and ViT models both in Keras and PyTorch.
- For our long term goals (analyzing the impact of visual and textual actuality on popularity):
 - The New York Times headlines scraped since 2011.
 - Tried OCR (with little luck, due to fairly diverse text formats, placements, etc.)
 - Built a meta model which can distinguish between 100+ categories (based on their imagery) of memes with an accuracy of 95%.

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Thank you for your attention!

Deep Learning Project

- **Team name:** GoalDiggers
- **Team members:** Viet Hung Pham, József Pintér, Bálint Turi-Kováts
- **Title:** Predicting the Popularity of Reddit Memes with Deep Learning
- **Main result:** CNN and ViT models with solid performance.