HinReddit

Group Member

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CheckPoint Task List

Week 1:

Goal: Create data ingestion pipeline to download reddit post content along with user information.

Tasks:

- Shuibenyang
  - Create functions to obtain information of a Reddit post given post id/link, and save the information as a csv file. Information includes text content, post id, post title.
  - Create functions to obtain all reply ids (flattened) given post ids, and save the information as a json file.
  - Create functions to obtain information of a reply given its id, and save the information as a csv file. Information includes author id and post id of the reply.
  - Put functions together and create a reddit post ingestion pipeline.
- Chengyu
  - Test the ingestion pipelines and check outputs on DSMLP server, debug if needed.
  - Output the test data and data used for EDA
  - Write report (Datasets, Obtaining Data, Data Ingestion: Privacy Concerns, Schema, Pipeline)
- Yanyu
  - Consult past researches on hateful speech detection and sentimental analysis.
  - Revise proposal
  - Write report (Relation with HinDroid, Related Works, Data Ingestion: Legal Issues)
- Yu-Chun
  - Revise weekly schedules and create backlog
  - Research on the method for labeling our dataset, and find the methods and write code to implement those methods such as BERT and NLP.
  - Write report (Datasets, Data Ingestion: Pipeline, Labeling)

1. Hateful Post Classification

As countless social platforms are developed and become accessible nowadays, more and more people get used to posting opinions on various topics online. The existence of nagetive online behaviors such as hateful comments is also unavoidable. These platforms thus become prolific sources for hate detection, which motivates large numbers of scholars to apply various techniques in order to detect hateful users or hateful speeches.

In our project, we plan to investigate contents from Reddit, which is a popular social network that focuses on aggregating American social news, rating web content and website discussion, that carries rich potential information of contents and their authors. Our goal is to classify hateful posts from the normal ones. Being able to identify hateful posts not only enables platforms to improve user experiences, but also helps to maintain a positive online environment. **We would like to stress that the boundary of 'hate' is vague and there is no correct nor consolidated definition of 'hatefulness,' our classification of hateful posts depends only on a unified definition within our team, which we divide into the categories of `severe_toxic`,`threat`, `insult`, and `identity_hate`.** We all agree that other people's recognition of "hate" may be but not limited to these four categories, and our labeling method allows full freedom of other definition of "hatefulness."

We plan to use Bidirectional Encoder Representations from Transformers (BERT), a neural network architecture transforming natural language processing (NLP) techniques, in our data ingestion pipeline for data labeling. However, instead of using NLP in attempts to solve classification problems, we will be using graph embedding methods. Specifically, we will create a heterogeneous information network to capture the relationships among Reddit posts, which is then used as our features.

If our project is successful, we will have built an application, *hinReddit*, which helps identify hateful posts for Reddit. Similarly, others can apply our process on different social platforms. In addition, we will create a blog post including an EDA on the data we extracted and detailed description of the process we will complete to ingest data. We will perform feature engineering, develop a neural network model, and finally a summary of the test result of our model.

2. Relation with HinDroid

Detecting hateful posts on Reddit is similar to our domain problem of detecting Android malware both conceptually and technically. Despite using different platforms, these two case studies both aim at identifying the malicious units from the benign units, and the goals are to produce a healthier and more positive environment to users. As we did in our replication using graph embedding techniques, here in our study, we will also pay attention to the connections as well as the communities of our object and construct heterogeneous information network (HIN) upon those connections that enables further training and classifications.

Specifically, in our HIN graph, we will have Reddit post nodes equivalent to App nodes in the replication project and user-interaction nodes equivalent to API nodes in the replication. While Hindroid investigates more of the relationships among API calls, for instance, having three out of four matrices developing different interactions of APIs, and thus focuses less on relationships among Apps themselves, we plan to add to our HIN the relationship among Reddit post nodes themselves to further diversify our network graph.

3. Related Works

Studies regarding the detection of hateful speech, content, and user in Online Social Networks have been manifold. In the report Characterizing and Detecting Hateful Users on Twitter, the authors present an approach to characterize and detect hate on Twitter at a user-level granularity. Their methodology consists of obtaining a generic sample of Twitter’s retweet graph, finding potential hateful users who employed words in a lexicon of hate-related words and running a diffusion process to sample more hateful users who are closely related in the neighborhood to those potential ones. However, there are still limitations to their approach. Their characterization has behavioral considerations of users only on Twitter, which lacks generality to be applied to other Online Social Networks platforms. Also, with ethical concerns, instead of labeling hate on a user-level, we want to avoid tagging individuals and believe that detecting hate on a content-level will be more impartial.

4. Datasets

Our project includes two datasets:

1. Main dataset used for our project analysis This is a dataset we will obtain from Reddit through a couple APIs. We use the API called PushShift to obtain Reddit post information, including post text, title, and user ids who reply to either the post itself or any of the reply below the post and the comments that it provided. We use `PushShift` because it offers a specific API to obtain the flattened list of repliers' ids and takes considerably less time than doing the same with PRAW. After a brief EDA on the most popular 124 subreddits, we select 50 subreddits in which the proportion of valid text posts of the posts are the highest and then sample a number of newest posts in each of the 50 subreddits. We want to eliminate image/meme posts and deleted posts so we can better apply NLP model.

    - advantages:
        - This dataset is obtained from the actual social platform, and thus we obtain real-world perspective when training.
        - Reddit has a couple APIs for us to suit our different needs.
    - limitations:
        - There are no ground-truth labels we can use for the data we collect, and thus need the assistance of other well-defined and pre-trained models to first label our data.
        - We are not certain of the level of hatefulness from Reddit posts we obtain, and may lead to an unbalanced number of posts in benign and hateful categories.

    - Our dataset will include newest posts in each subreddit, and may not apply well for older posts.

2. Kaggle Toxic Comment Classification Dataset This is a dataset provided on https://www.kaggle.com/c/jigsaw-toxic-comment-classification-challenge/data, including information of hundreds of thousands of wikipedia comments along with multiple negative labels. We will be mainly using this dataset to train a nlp pretrained BERT classifier model to label our reddit post data before we use it for HIN learning.

    - advantages:
        - This dataset is labeled, allowing us to perform supervised learning to train a nlp classifier model.
        - The dataset include several labels, including `severe_toxic`, `obscene`, `threat`, `insult`, `identity_hate`, thus giving us some space to define what constructs a hateful post.
    - limitations:
        - We are not certain if labels for wikipedia comments can be applied to posts from Reddit or other social platforms.

5. Data Ingestion Process

5.1 Data Origination and Legality

1. Our data entirely originates from Reddit. We will be using the Reddit APIs to obtain the data from the website. As stated in Reddit's API Terms of Use, in order to legally use the Reddit API, it is necessary for us to agree with all the applicable policies and guidelines listed in the Terms of Use. With a careful review of the document, we understand that we have satisfied all requirements and grant consent on all Terms. Moreover, since we have registered Reddit accounts agreeing with all terms and conditions, we believe our usage of the Reddit API is legal.

2. The Kaggle Toxic Comment Classification data originates from the comments of Wikipedia’s talk page edits and is distributed through a closed Kaggle competition. According to the Competition Rules, for the specific "competition data", or the datasets available from the the Competition Page for the purpose of use in the Competition, users are allowed to access or use the data for academic research and education, or non-commercial purposes. Our usage of the data will not violate the rules.

5.2 Privacy Concerns

As Reddit is an online public social platform and all posts and replies are open to viewers, we will not get into issues regarding privacy. Nevertheless, we will encrypt all users' personal information if involved and eliminate sensitive posts or replies in case of any information leakage.

5.3 Schema

After extracting the posts and comments using the `PushShift` API, we have organized the data into three layers. As shown below, under the raw folder it contains the three layers, *post_detail*, *posts* and *comments*. The name of the files under each folder corresponds to each subrredit where the contents are taken from.

```
data/
|--raw/
```

```
|   |-- post_detail/
|   |    |-- science.json
|   |    |-- videos.json
|   |-- posts/
|   |-- |-- science.csv
|   |-- |-- videos.csv
|   |-- comments/
|   |    |-- science.csv
|   |    |-- videos.csv
```

First Layer: Posts

The csv file contains the information of each post in a dataframe where the unit of observation is the individual post.
`id`: post_id `author`: username of the author who make the post `title`: title of the post `selftext` `num_comments`: number of comments `created_utc`: the epoch date for which the post is created `full_link`: the link to the reddit post `subreddit`: subreddit it belongs to `score`: number of upvote - number of downvote

Second Layer: Post detail

The file contains certain number of posts id and all of its comments id under a certain subrredit.
`submission_id` : id of the post `comment_ids`: id of each comment

```
[{"submission_id":"fsoala","comment_ids":[]},
{"submission_id": "fsnmj4", "comment_ids": ["fm2fd48", "fm2hrmh",
"fm2k37i", "fm2k8p4", "fm2kuot", "fm2lces", "fm2lsao", "fm2lu4n",
"fm2m5at", "fm3trkl", "fm4c7i6"]}]
```

Third Layer: Comments

The csv file contains the information of each specific post in a dataframe where the unit of observation is the individual comment.
`id`: comment id `author` : username of the author who make the comment `created_utc` : the epoch date for which the comment is made `is_submitter`: whether that person post the original post `subreddit`: the subreddit it belongs to `link_id`: the post id for which this comment is made for `send_replies`

5.4 Pipeline

triggered by `data-(read/eda/test)` in targets

- Create `config/data-params.json`, an example shown below. Information includes: POST_ARGS: parameter related to the post extraction part. META_ARGS: parameter related to the comment extraction part. The all the posts is sorted by the creation data and we extracted data prior to the date of `Tuesday,March 31 17:00:00 2020 PDT`.

```
{"POST_ARGS":
    {"sort_type":"created_utc",
    "sort":"dsc",
    "size":"1000",
    "start":"1585699200"},
"META_ARGS":
    {"filepath":".\/tests",
    "total":"1000",
    "meta":
["id","author","title","selftext","num_comments","created_utc","full_link"
,"subreddit","score"],
    "subreddits":
["amitheasshole","showerthoughts","politics","documentaries"]}}
```

- Sample a number of newest posts prior to a chosen daytime, the number specified in configuration file, from each subreddits specified in configuration file.
- Access and obtain reddit posts, reorganize, and same them as detailed in schema

5.5 Applicability

The above data ingestion pipeline can be used to obtain data as long as the data originates from Reddit. Our pipeline has limited applicability depending on data sources. Possible data sources include other online social platforms such as Twitter, Facebook, LinkedIn, and Instagram. Platforms have similar overall structure but differ in detailed construction and API calls, thus our pipeline may only be helpful for general data ingestion framework reference when applying to other online social platforms. Also, it is important to check the policies and guidelines of each platform before employing our pipeline to avoid the raise of legal issues or privacy concerns.

6. Labeling

Since the original data obtained from Reddit is not labeled, we will be using a pretrained model BERT, through python library `fast-bert`, to label the Reddit posts before we use it for our project main analysis.

By following documentation of `fast-bert`, we will train a NLP model with kaggle labeled dataset of wikipedia comments detailed in Datasets. We will save this model in directory `interim`. This multi-label model then can be used to classify each Reddit post as "hateful" according to either our definition, which is any of `severe_toxic`, `threat`, `insult`, `identity_hate`, or user-defined "hatefulness" using any combination of the five labels.

7. Proposal Revision

In the latest project proposal turned in last week, we intended to perform sentiment analysis instead of hateful post classification on the content of Reddit due to data labeling issue. This week, after a deeper investigation of BERT, we believe it is possible to label our data by categories of negative behaviors, which we discuss in detail in the labeling section. Thus, having a consistent definition of ‘hate’ within our team, we make it achievable to label hateful contents, and we agree on changing back to our original idea of hateful post detection. We also propose a solution to different definition of ‘hatefulness’ to expand the applicability of our model.

8. Backlog

- Combine data ingestion pipeline and labeling process to organize labels according to the data.
- EDA.
- Create functions for baseline model using extracted EDA data directly as features
- Put functions together to create a baseline model pipeline.
- Create functions to create matrix for each relation detailed above (will assign different relations to members)
- Put functions together to create a matrix pipeline.
- Report (Graphs, EDA, Baseline Model)
- Create a function to combine the graphs
- Finish creating the HIN given our training data
- Create functions that take in an HIN graph to create vectors for each post node