CAPSTONE 2: PREDICTING KICKSTARTER CAMPAIGN OUTCOMES USING NLP

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Springboard – May 2019

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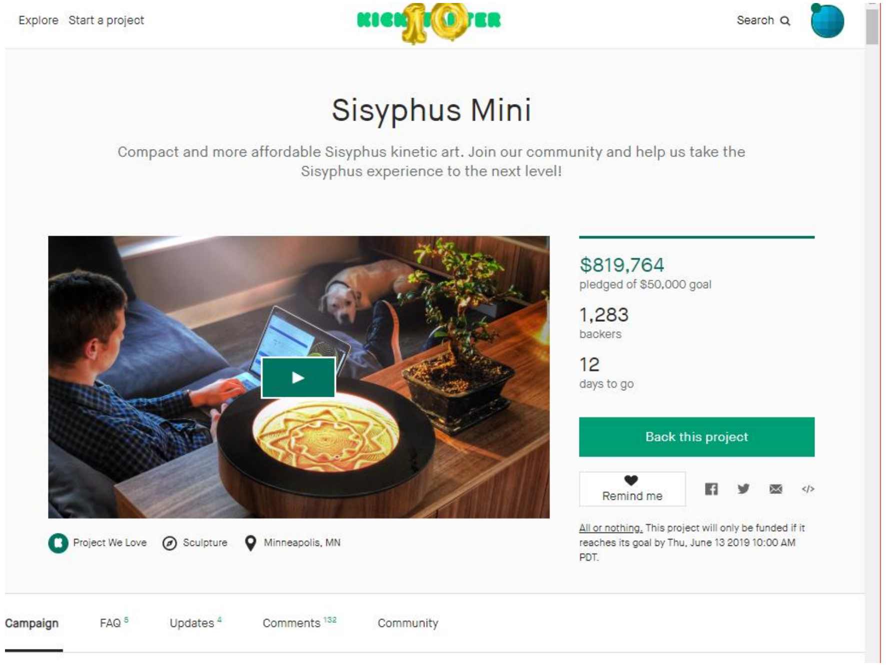
- Goal:
  - Predict campaign success on Kickstarter by leveraging NLP techniques.
- Potential Interested Parties:
  - Potential creators wanting to understand how well their campaign will perform
  - Competitive crowdfunding sites wanting to understand drivers of successful campaigns
- Data Source:
  - CSV files hosted on Web Robots, site which scrapes Kickstarter monthly

- Outcome:
  - Create predictive model utilizing numeric, text and categorical data in order to predict whether a campaign is successful within 15 days of being launched.



Sisyphus Mini

Compact and more affordable Sisyphus kinetic art. Join our community and help us take the Sisyphus experience to the next level!

$819,764 pledged of $50,000 goal

1,283 backers

12 days to go

Project We Love · Sculpture · Minneapolis, MN

All or nothing. This project will only be funded if it reaches its goal by Thu, June 13 2019 10:00 AM PDT.

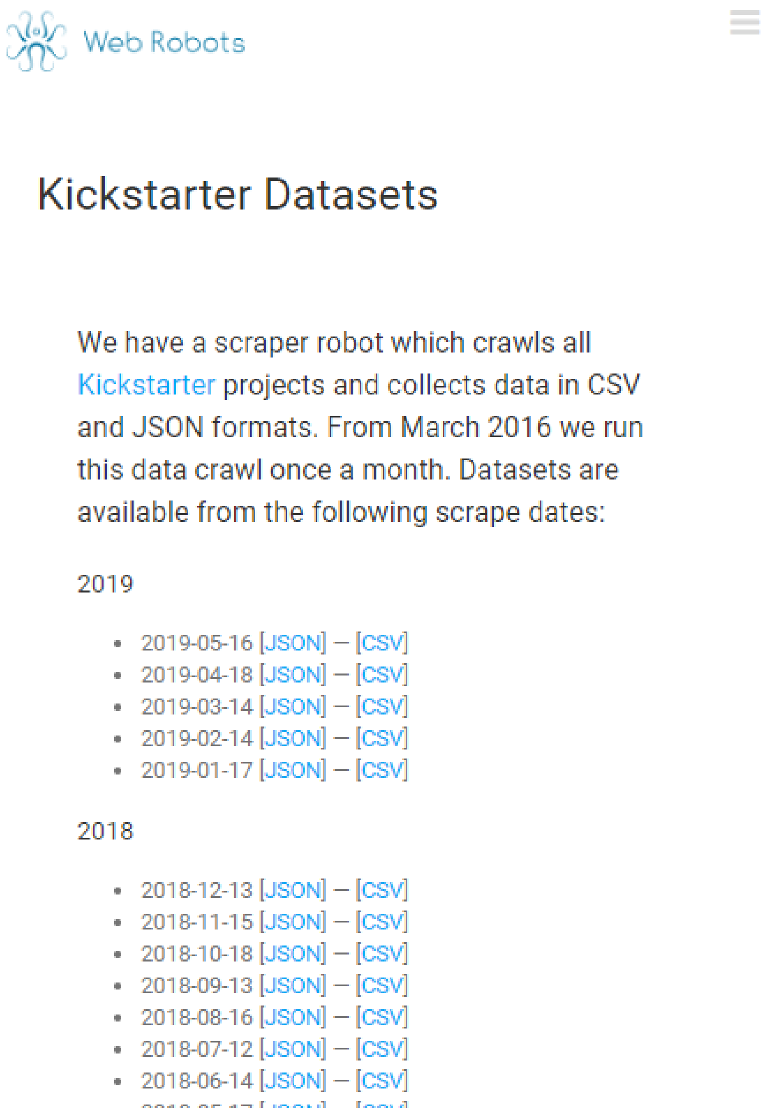
Example of a Kickstarter campaign – one of the most successful in Kickstarter history!

DATA OVERVIEW

- ❖Series of CSV files posted to site hosted by webrobots, consisting of monthly scrapes from April 22, 2019 to current month
- ❖Each scrape produced 25=50+ csv files, stored in folders corresponding to the date scraped.
- ❖Single row represents single campaign, with each scrape being a poir in time snapshot of the project
- ❖For this project, used data from Jan 28, 2016 to April 2019

❖Available Features:

- ❖'backers_count', 'blurb', 'category',
- ❖ 'converted_pledged_amount', 'country', 'created_at', 'creator',
- ❖ 'currency', 'currency_symbol', 'currency_trailing_code',
- ❖ 'current_currency', 'deadline', 'dirname', 'disable_communication',
- ❖ 'friends', 'fx_rate', 'goal', 'id', 'is_backing', 'is_starrable',
- ❖ 'is_starred', 'last_update_published_at', 'launched_at', 'location',
- ❖ 'name', 'permissions', 'photo', 'pledged', 'profile', 'slug',
- ❖ 'source_url', 'spotlight', 'staff_pick', 'state', 'state_changed_at',
- ❖ 'static_usd_rate', 'unread_messages_count', 'unseen_activity_count',
- ❖ 'urls', 'usd_pledged', 'usd_type'



Kickstarter Datasets

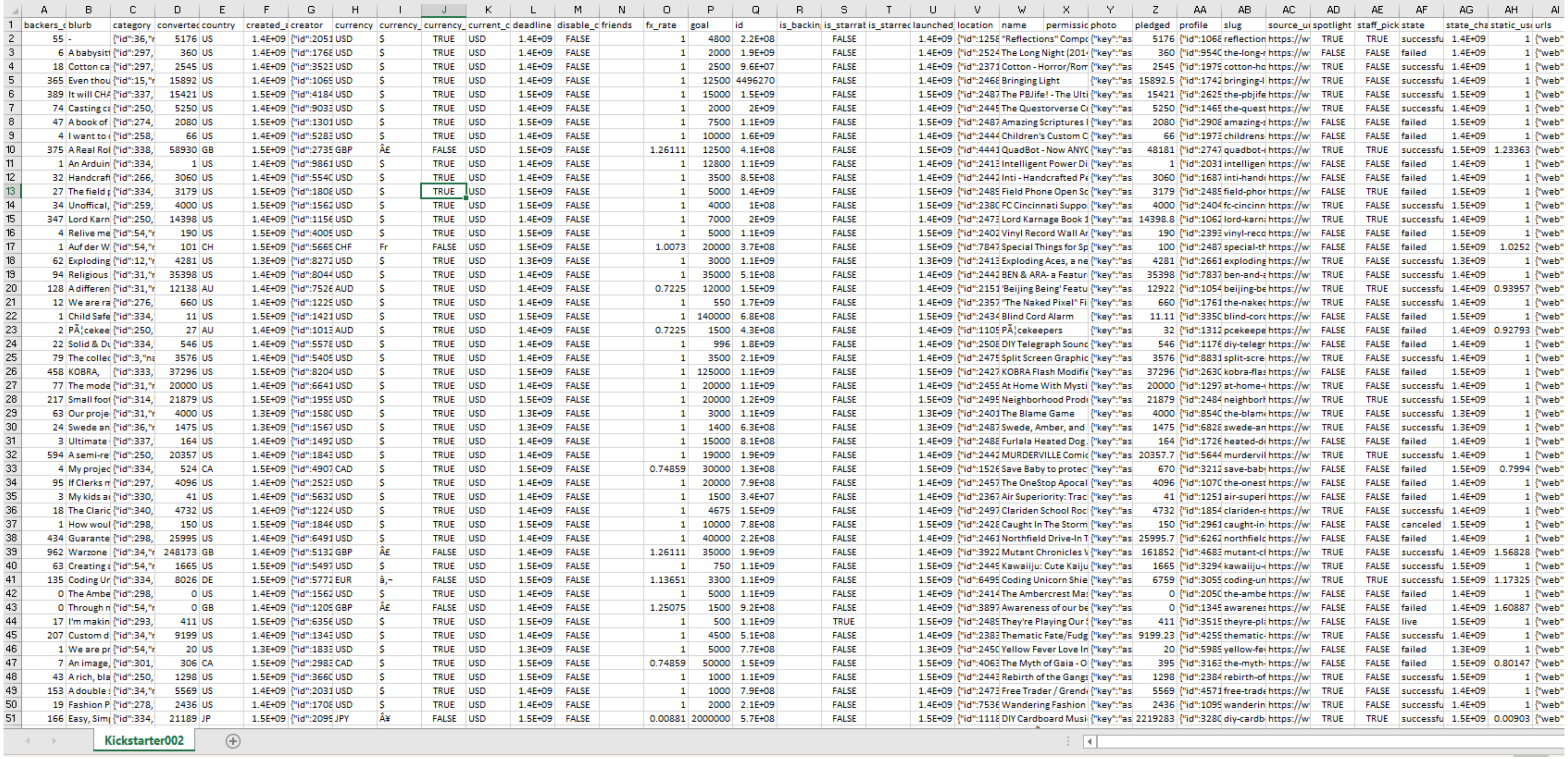
We have a scraper robot which crawls all Kickstarter projects and collects data in CSV and JSON formats. From March 2016 we run this data crawl once a month. Datasets are available from the following scrape dates:

2019

- 2019-05-16 [JSON] – [CSV]
- 2019-04-18 [JSON] – [CSV]
- 2019-03-14 [JSON] – [CSV]
- 2019-02-14 [JSON] – [CSV]
- 2019-01-17 [JSON] – [CSV]

2018

- 2018-12-13 [JSON] – [CSV]
- 2018-11-15 [JSON] – [CSV]
- 2018-10-18 [JSON] – [CSV]
- 2018-09-13 [JSON] – [CSV]
- 2018-08-16 [JSON] – [CSV]
- 2018-07-12 [JSON] – [CSV]
- 2018-06-14 [JSON] – [CSV]



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1	backers_c	blurb	category	convertec	country	created_a	creator	currency	currency_	currency_	current_c	deadline	disable_c	friends	fx_rate	goal	id	is_backin	is_starrat	is_starrec	launched	location	name	permissic	photo	pledged	profile	slug	source_ur	spotlight	staff_pick	state	state_cha	static_usc	urls
2	55	-	{"id":36,"r	5176	US	1.4E+09	{"id":2051	USD	$	TRUE	USD	1.4E+09	FALSE		1	4800	2.2E+08		FALSE		1.4E+09	{"id":1258	"Reflections" Compo		{"key":"as	5176	{"id":1068	reflection	https://w	TRUE	TRUE	successfu	1.4E+09	1	{"web"
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6	389	It will CHA	{"id":337,	15421	US	1.5E+09	{"id":4184	USD	$	TRUE	USD	1.5E+09	FALSE		1	15000	1.5E+09		FALSE		1.5E+09	{"id":2487	The PBJife! - The Ulti		{"key":"as	15421	{"id":2625	the-pbjife	https://w	TRUE	FALSE	successfu	1.5E+09	1	{"web"
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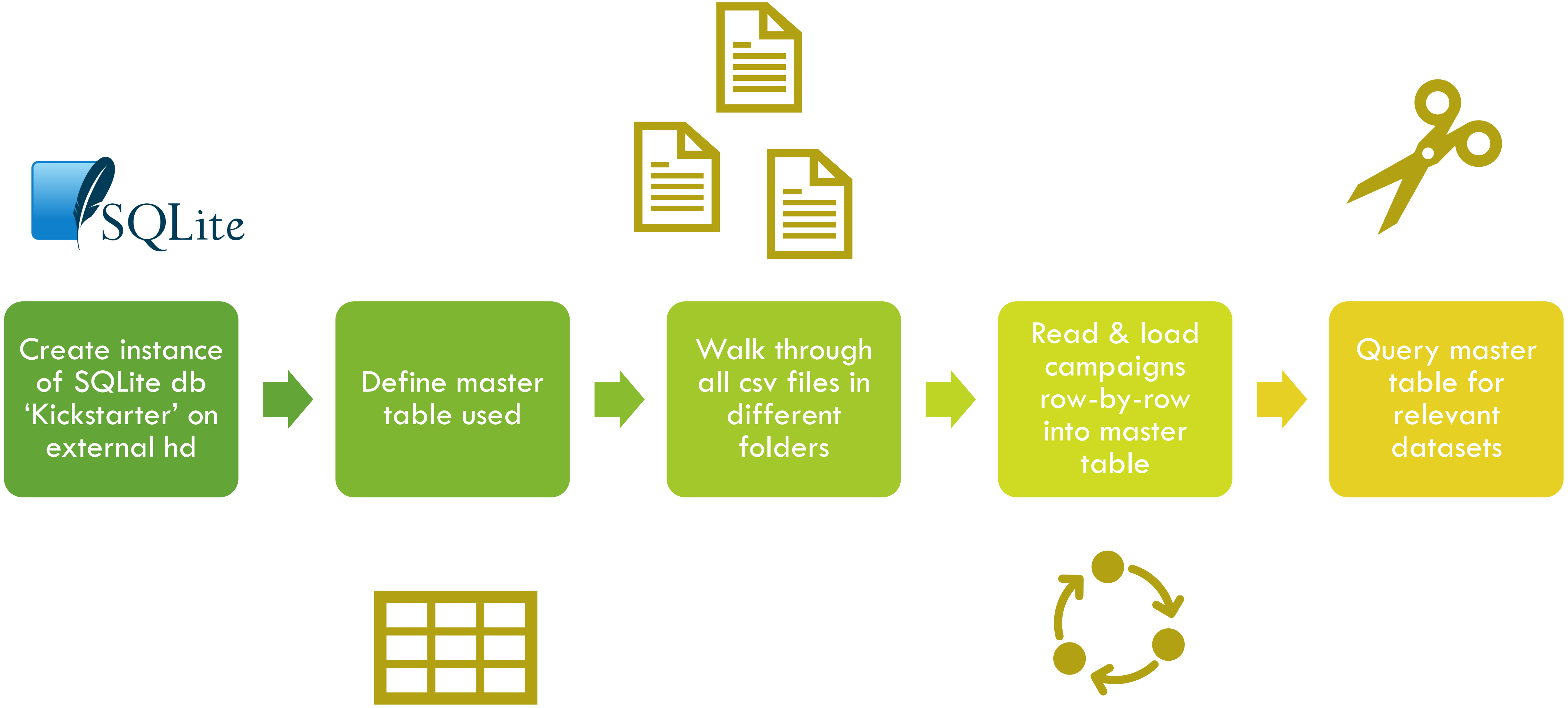
DATA ACQUISITION

- Challenges around data storage & training – testing data creation
  - Initial data set size: 30.6MB (Pandas data frame offered terrible performance)
  - Campaigns were duplicated across multiple scrapes (different snapshots) – needed to specifically isolate instances of records posted within 15 days of campaign
    - Needed to avoid data leakage regarding core metrics like backers, amount pledged, etc. and avg campaign was 30 days long.
  - Additional data processing needed to happen, especially the unix formatted datetime columns

- Solution
  - Created local instance of SQLite db on external drive
  - Create script to load files row by row into master table
  - Query master table for specific subsets of data
  - Merge to create data set for applying NLP and modeling



Create instance of SQLite db ‘Kickstarter’ on external hd

Define master table used

Walk through all csv files in different folders

Read & load campaigns row-by-row into master table

Query master table for relevant datasets

DATA PROCESSING & MERGING

- Two data sets needed:
  - Projects Outcomes: unique list of projects with end state – the labels (‘State’)
  - Projects Starting: snapshot of campaigns in the first 15 days of launching
    - Features used: Name, Blurb, Creator, Category, Goal, Created At, Launched At, Deadline, Location
  - Merged dataset – very well balanced with regard to class:
    - Failed: 823 campaigns
    - Successful: 796 campaigns

- Additional Processing Required
  - Unpacking nested JSON like columns: creator, category, location
  - NLP Specific:
    - Leveraged Spacy by:
      - Using pre-trained statistical model for English
      - Removing stop words, performing lemmatization, and converting tokens to lower case
    - After processing, text columns were then combined into a single column to then be used for BAG of Words, N-grams and TFIDF later

FEATURE ENGINEERING & SELECTION

- Given limited sample size & available features, feature selection options were limited & I decided to use as many as possible

- Aside from text features, train-test included:
  - Goal, category, country, state, city, time to launch, launch to deadline, launched month, launched year, created month, created year, deadline month, deadline year (total: 13)

- Process:
  - Pipelines created to select numeric, text, & categorical columns
  - Numeric pipeline:
    - Utilized SimpleImputer to fill nan's with 0's (instead of the mean, etc) as using the mean would have been misleading (i.e. some campaigns could truly have taken less time to launch, etc.)
  - Categorical pipeline:
    - Utilized SimpleImputer, OneHotEncoder
  - Text pipeline:
    - This is where I experimented with different combinations of NLP techniques including Bag of Words, TFIDF Vectorizer, N-grams to explore which techniques could work best

MODEL SELECTION & PERFORMANCE

I'M A BACKER

- Because of the inclusion of text data & feature engineering techniques like Bag of Words, N-grams, etc. + the small sample size, a big driver of model selection was focused on the ability to utilize a sparse array

- Classification models known to do well with sparse arrays & high dimensional data (even in cases where columns outnumbered actual record size) included:
  - Logistic Regression
  - Linear SVC (SVM's in general)
  - Random Forest Classifier

- Results:
  - Models performed equally well around ~65% accuracy (with cross validation (cv=5))
  - Hyperparameter tuning of Random Forest model with bi-grams & TFIDF transformer added additional ~2% lift in model accuracy

- Interpretation:
  - Given the near equally dismal performance of all model variants, additional data + text based features could potentially have provided more insight into drivers of campaign success

MODEL SELECTION & PERFORMANCE

<table>
<tr><th>Model Type</th><th>Bag of Words</th><th>TFIDF</th><th>N-grams</th><th>Hyperparameter Tuning</th></tr>
<tr><td rowspan="2">Logistic Regression</td><td>Model Variant 1:
Accuracy: 65%</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Model Variant 3:
Accuracy: 66%</td><td></td><td></td></tr>
<tr><td>Linear SVC</td><td>Model Variant 2:
Accuracy: 64%</td><td></td><td></td><td></td></tr>
<tr><td>Random Forest Classifier</td><td></td><td colspan="2">Model Variant 4:
Accuracy: 66%</td><td>Hyperparamter tuning:
Accuracy: 68%</td></tr>
</table>

TAKE AWAY & NEXT STEPS

Project Specific Mentions:

- For NLP to be effective, lots of data is needed + for NLP to be effective in prediction, as many or more labeled samples
- Time duration + frequency of data collection key in being able to (1) isolate early conditions of observatory units + (2) understand time-based trends like pledging behavior.
- Model interpretability key to socializing model outcomes + decisions; pipelines offer way to streamline & productionalize models but also make interpretability challenging

Next Steps

- Applying learnings from this project to similar projects with similar desired outcomes + higher quality, volume data appropriate for NLP
- Exploring the use of Deep Learning models involving NLP tasks

ABOUT ME

ABOUT ME

Applied analytics and data science evangelist, Mikiko Bazeley is a seasoned analyst with 5+ years of working in high-impact roles for start-ups and enterprise tech companies.

A UCSD Economics & Anthropology graduate, Mikiko aims to use her experience in social research & modeling to strategically leverage data science in order to drive new insights for sales, marketing, finance & customer success organizations. Mikiko is also GIS & Supply Chain Management certified.

Prior to joining WalkMe (where she focuses on scaling data science & global sales analytics) Mikiko worked as a Data Scientist at Autodesk (focused on understanding product adoption & user health), as well as assisting with scaling strategic finance initiatives at Sunrun (the largest residential solar company in the US).

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