DESCRIBING & PREDICTING THE SUCCESS RATE OF KICKSTARTER PROJECTS

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1. PROJECT OVERVIEW AND OBJECTIVES

Online fundraising platforms are becoming more and more popular. However, the majority of projects turn out to be ***unsuccessful***

Goals

- Use ***descriptive statistics*** to learn more about already completed projects
- Use ***machine learning*** to find the factors that play a key role in determining the outcome of a project (i.e. success or failure) and make predictions

2. DATA DESCRIPTION

Data source: Kickstarter Projects dataset, available on Kaggle

	name	category	main_categor	currency	country	status	launched_dat	deadline	days_allotted	fundraising_goal	fundraising_pledged	completion_percentage	backers
2	0 The Songs of	Poetry	Publishing	GBP	GB	failed	8/11/15	10/9/15	59	1533	0	0	0
3	1 Greeting From	Narrative Film	Film & Video	USD	US	failed	9/2/17	11/1/17	60	30000	2421	8	15
4	2 Where is Hani	Narrative Film	Film & Video	USD	US	failed	1/12/13	2/26/13	45	45000	220	0	3
5	3 ToshiCapital F	Music	Music	USD	US	failed	3/17/12	4/16/12	30	5000	1	0	1
6	4 Monarch Espr	Restaurants	Food	USD	US	successful	2/26/16	4/1/16	35	50000	52375	104	224

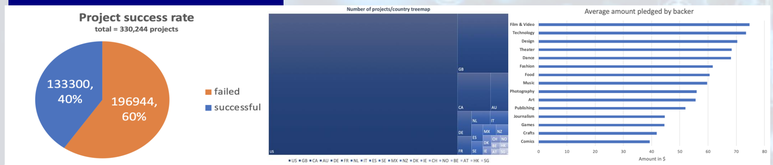
(cleaned dataset overview)

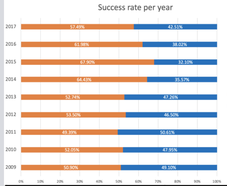
Data cleaning:

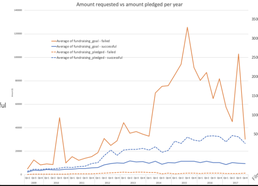
- Renamed and reordered columns
- Fixed data types
- Parsed variables with dates
- Only kept projects that *failed* or were *successful (88% of original data)*
- Removed country named 'N,0"'"'
- Dropped redundant columns/incorrect data
- Removed rows that had a fundraising goal of $0
- Created columns (*day_allotted, completion_%)*
- Checked for NAs

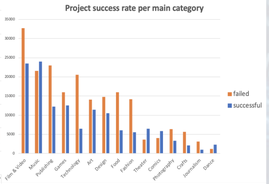
CLEANING	*before*	*after*
# rows	377,364	**330,244**
# columns	15	13

3. DATA EXPLORATION

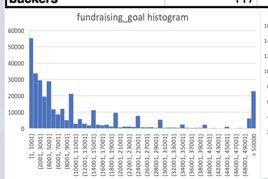


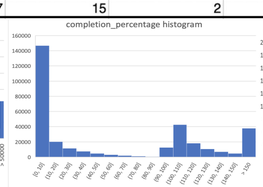


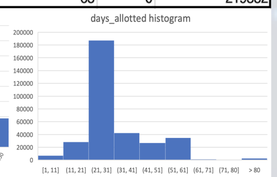


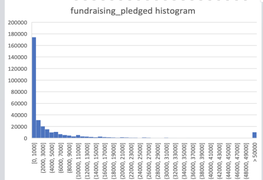


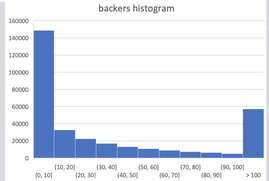
SUMMARY STATISTICS	mean	median	Q1	Q3	min	max
fundraising_goal	$ 41,616.83	$ 5,000.00	$ 2,000.00	$ 15,000.00	$ 1.00	$ 166,361,390.00
fundraising_pledged	$ 9,962.68	$ 787.00	$ 50.00	$ 4,614.00	$ -	$ 20,338,986.00
days_allotted	34	30	30	36	1	92
completion_percentage	344	20	0	109	0	10427700
backers	117	15	2	63	0	219382











4. MODEL DESCRIPTION

Classification task with **a binary** outcome (success, failure)

Features used for machine learning

- **1st round of models:** *main_category, country, launch_month, launch_day, launch_weekday, days_alloted, fundraising_goal*
- **2nd round of models:** *main_category, **name**, country, launch_month, launch_day, launch_weekday, days_alloted, fundraising_goal*

Feature engineering

- *main_category, country, launch_month, launch_day, launch_weekday* → dummy variables
- *days_allotted* → untouched
- *fundraising_goal* → log transformation *(common with positive right-skewed data w/ outliers)*
- *name…*
  - ✓ → lowercased, punctuation removed with regex, tokenized
  - ✓ → stopwords removed *(list taken from tm package in R)*
  - ✓ → *vectorized, converted to term frequency–inverse document frequency (tfidf)*

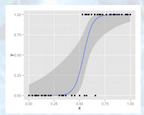
*Number of features without text: **56***
*Number of features with text: **56 + 92,680 tokens***

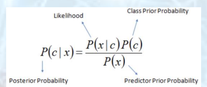
status	name	main_category_Food	main_category_Art	main_category_Fahion	main_category_Publishing	…
0	0 The Songs of Adelaide & Abullah	0	0	0	1	
1	1 Greeting From Earth: ZeroG Capsule For ET	0	0	0	0	
2	2 Where is Hank?	0	0	0	0	
3	3 ToshiCapital Rekordz Needs Help	0	0	0	0	
4	4 Monarch Espresso Bar	1	0	0	0	

(dataset after feature engineering)

Models used in round #1 (*without* text features)

- **Logistic regression** *(scaled data)*
  - $\lambda = 0$ $\alpha = 0$ *(no elastic net regularization)* ✓
  - $\lambda = 0.02$ $\alpha = 0.2$
  - $\lambda = 0.1$ $\alpha = 0.4$
- **Random forest** *(unscaled data)*
  - maxDepth=1 numTrees=60
  - maxDepth=6 numTrees=100
  - maxDepth=6 numTrees=80
  - maxDepth=15 numTrees=80 ✓
- **Naïve Bayes**
  - smoothing=1.0 *on unscaled data* ✓
  - smoothing=5.0 *on unscaled data*
  - smoothing=1.0 *on scaled data*





Models used in round #2 (*with* text features)

- **Logistic regression**
  - *With same parameters as found for the best model in round #1 for maximizing run time*
- **Random forest**
  - *Eventually dropped as a candidate algorithm for round #2 due to the large number of text features (we conducted many experiments – the server would always crash after a few hours)*
- **Naïve Bayes**
  - *With same parameters as found for the best model in round #1 for maximizing run time*

5. MODEL COMPARISON METRICS

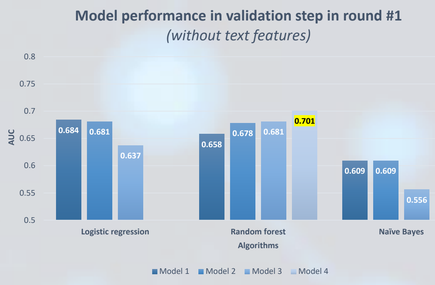
The data was split into **3 datasets**:

training (60%) *used to fit the models* → **validation (30%)** *used to pick best model of the same algorithm* → **testing (10%)** *used to compute generalization performance of best model on unseen data*

AUC ROC curve was used for evaluating the **performance** of models

6. RESULTS – PREDICTION PERFORMANCE

1. validation performance:



2. testing performance:

ROC AUC (testing data) of models	*without* text features	*with* text features
Logistic regression	0.685	0.657
Random forest	**0.701** *[highest accuracy]*	*[candidate dropped]*
Naïve Bayes	0.612	0.460

Confusion matrix	pred(0)	pred(1)
actual(0)	16,825 TN	2,975 FP
actual(1)	8,365 FN	5,049 TP
precision: 0.63	*recall 0.38*	

7. RESULTS - INFERENCE

Logistic regression feature importance
*In round #1 without text features (**AUC=0.685**)*

feature	coefficient
main_category_Dance	0.78013493
main_category_Theater	0.73181417
main_category_Comics	0.53967011
country_HK	0.38315105
…	…
main_category_Journalism	-0.948189
main_category_Crafts	-1.0626787
days_allotted	-1.4184967
log_fundraising_goal	-5.1330291

Random forest feature importance
*In round #1 without text features (**AUC=0.703**)*

feature	importance
log_fundraising_goal	0.35976
days_allotted	0.1956476
main_category_Technology	0.04770462
main_category_Music	0.04627876
main_category_Theater	0.03969938
main_category_Fahion	0.03245688
main_category_Comics	0.02516374
main_category_Food	0.02272381
…	…

WORD CLOUD #2
Here, the color of coefficients **has no meaning**

8. CONCLUSION

- Performance was quite **high** overall with random forest (approx. 70%)
- As a result, success rate may not only depend on the data and could also greatly vary based on factors that are unavailable to us/specific to each project
- Text features did not help improve performance with these models

FUTURE WORK *(a data science project is never over! 🤘⛔)*

- Rerun logistic regression on text features using elastic net regularization despite the very high computational cost, and utilize/implement more algorithms which allow for more complex learning (e.g. neural networks)
- Attempt to predict *fundraising_pledged* and *number of backers (i.e. numeric variables with a linear relationship instead of categorical ones/classification outcomes)*
- Retrieve more data/projects to improve performance