

The Formula for a Blockbuster

Can movie producers predict their next hit?

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Problem:

Movie producers have trouble predicting the success of their investments.



King Arthur made \$39.1 million and cost \$175 million!

Solution:

**Mine public data on movies to see
if certain variables relate to
box-office success.**

Language

Actors

Region

Genre

Producer

Run time

Release

...

Early signals from our data:

It pays to **be an American producer.**

It pays to **make an adventure film.**

It pays to **make a mega-franchise film like Harry Potter.**

It pays to **release mid-year.**

It pays to **keep your runtime under 200 minutes.**

These findings deserve further analysis.

Acquisition and organization of information

Data Acquisition

TMDb API

TMDb is a community built movie and TV database. 23 kinds of Metadata on ~50,000 movies (~6M rows after normalization)

<https://www.themoviedb.org/documentation/api>

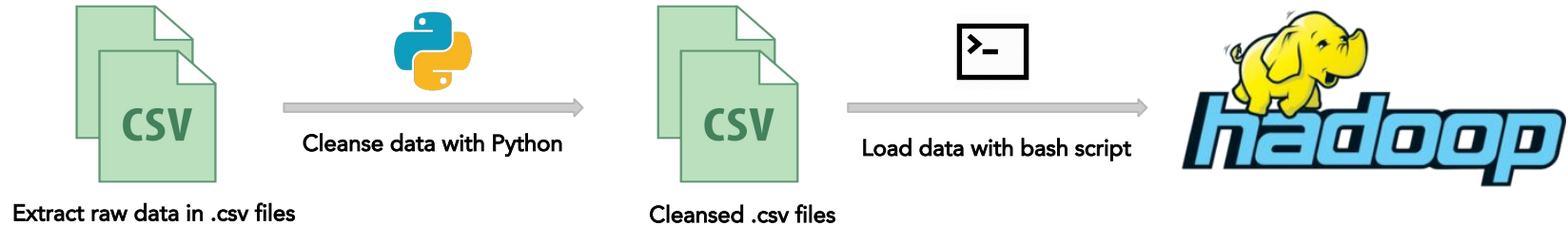
MovieLens | GroupLens

Rating datasets from the MovieLens web site, which feature a MovieLens 20M dataset (20M ratings on 27,000 movies by 138,000 users)

<https://grouplens.org/datasets/movielens/>

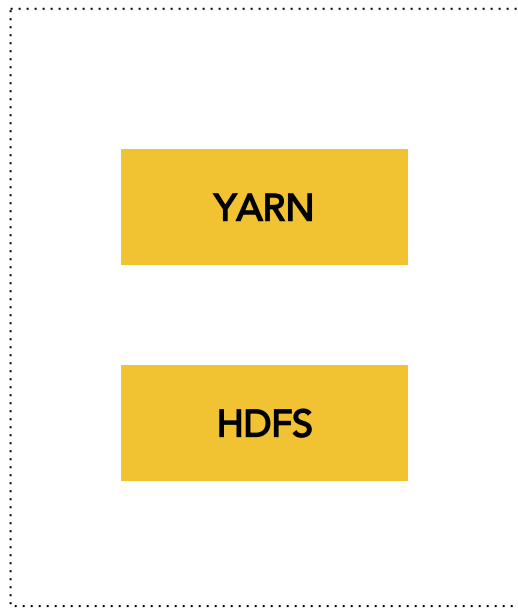
Acquisition and organization of information

Data ETL

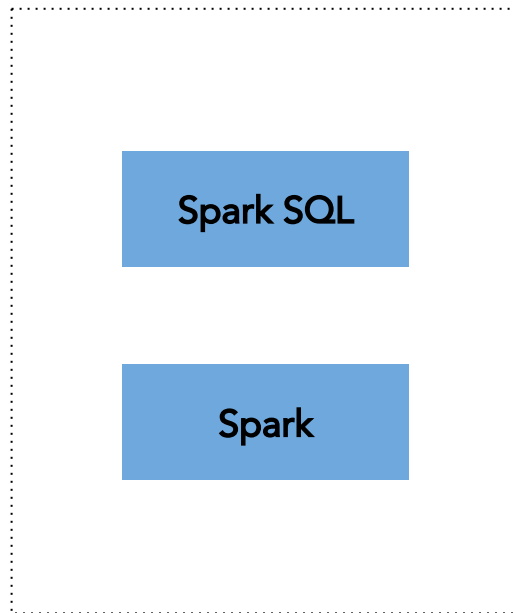


Architecture and Implementation Details

Data Storage



Data Processing



Data Serving

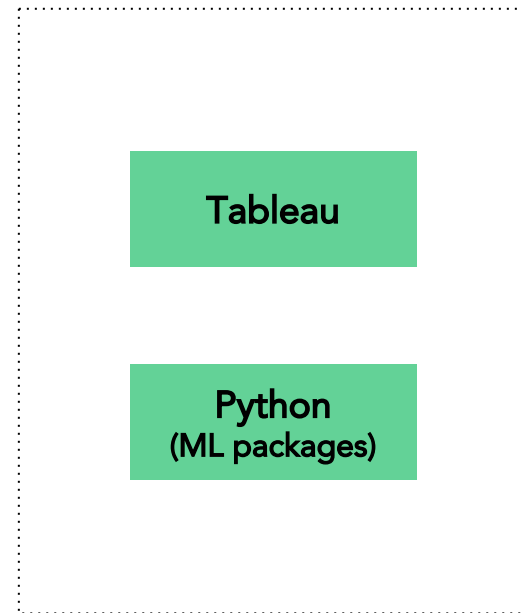
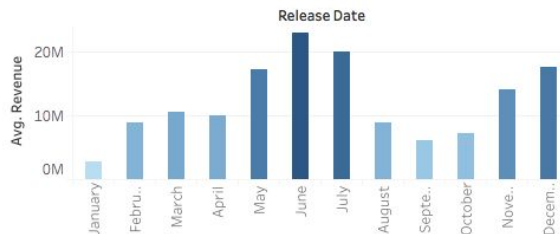


Tableau:

Key movie revenue analysis

From the data collected, we looked into the relationship between Revenue and key variables of interest. And we have some interesting findings:

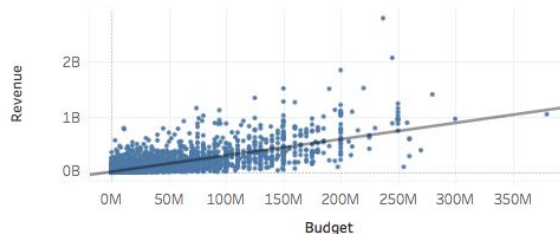
Average Revenue vs Release Month



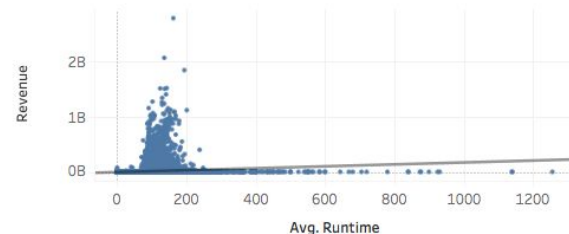
Revenue vs Franchise Status



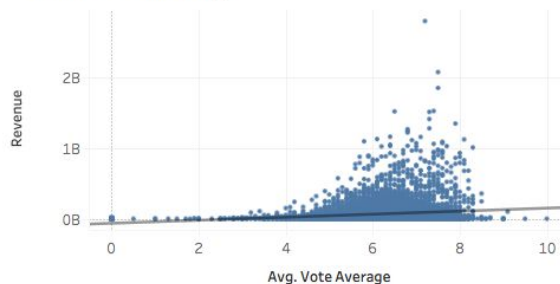
Revenue vs Budget



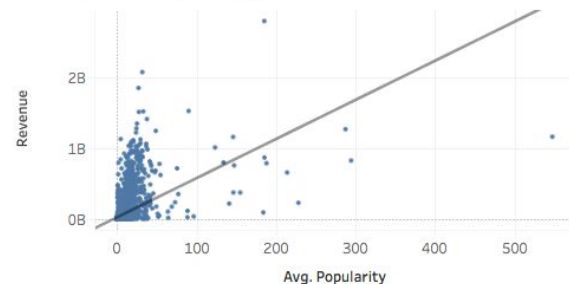
Revenue vs Runtime



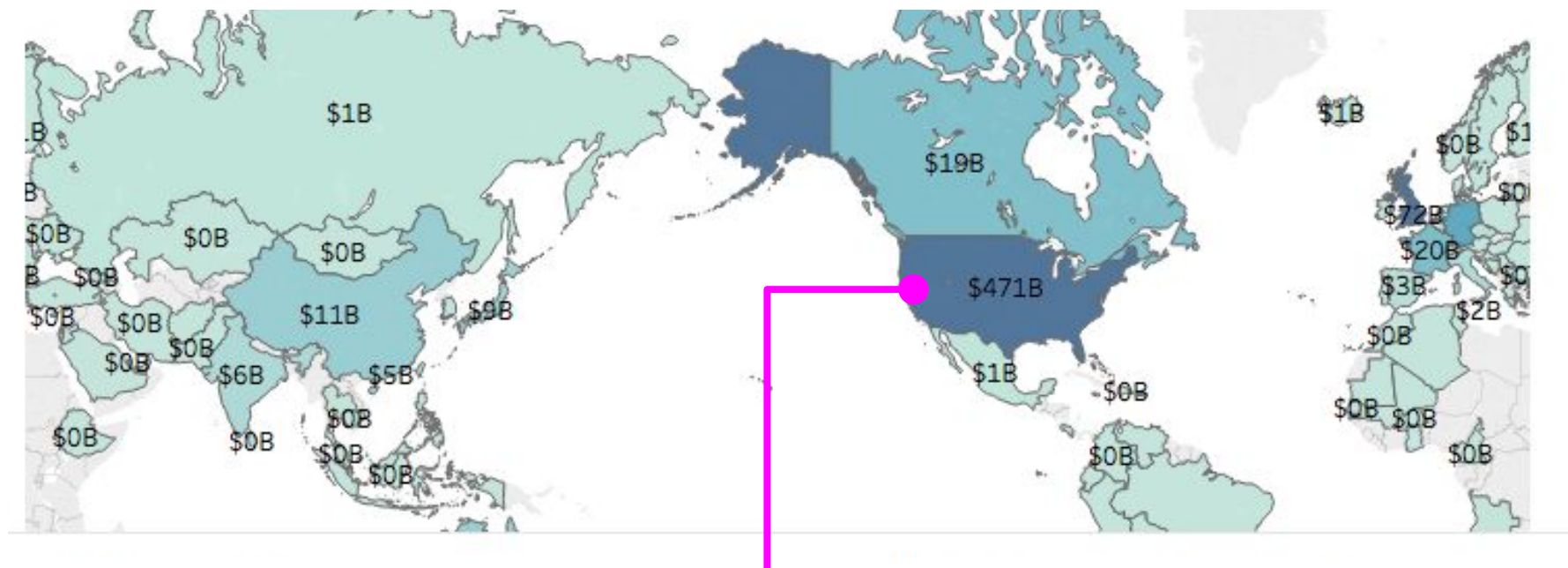
Revenue vs Vote Avg



Revenue vs Popularity



Findings: Total Revenue by Country



In our dataset, US movie producers generated the highest gross revenue.

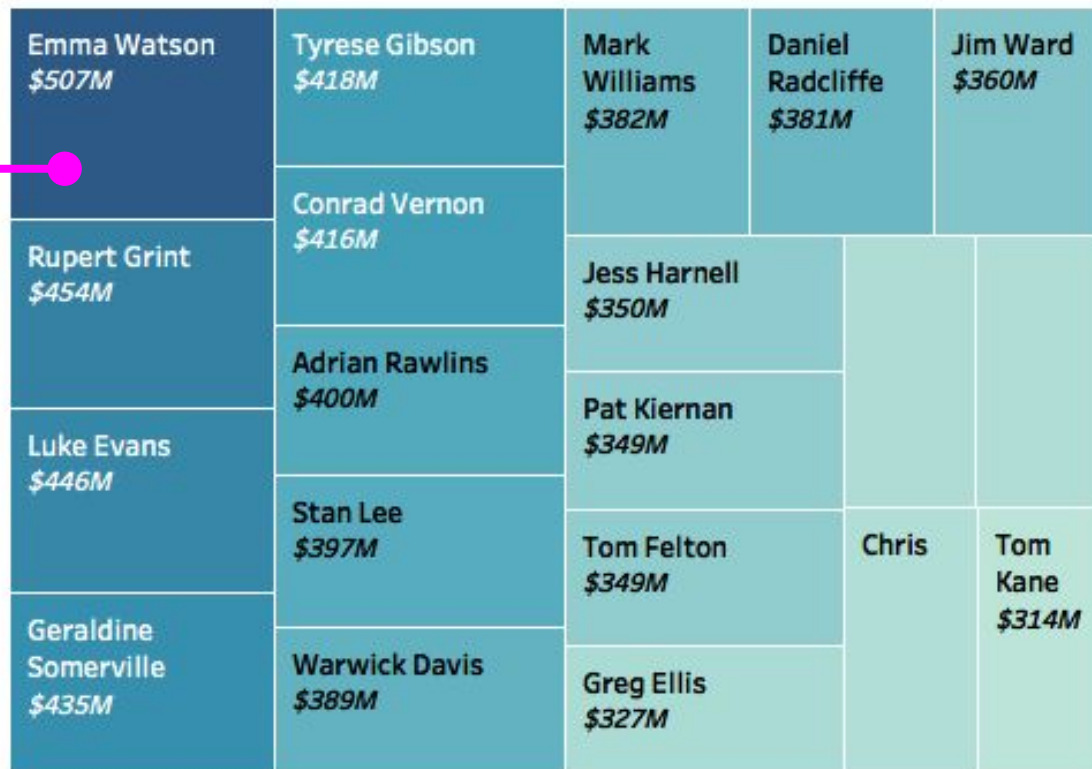
Findings: Average Revenue by Genre

Genre “Adventure”
associates with the
highest average revenue



Findings: Top 20 actors* by average revenue

Emma Watson leads
all actors in highest
average (associated)
movie revenue



Emma Watson \$507M	Tyrese Gibson \$418M	Mark Williams \$382M	Daniel Radcliffe \$381M	Jim Ward \$360M
Rupert Grint \$454M	Conrad Vernon \$416M	Jess Harnell \$350M		
Luke Evans \$446M	Adrian Rawlins \$400M	Pat Kiernan \$349M		
Geraldine Somerville \$435M	Stan Lee \$397M	Tom Felton \$349M	Chris	Tom Kane \$314M
	Warwick Davis \$389M	Greg Ellis \$327M		

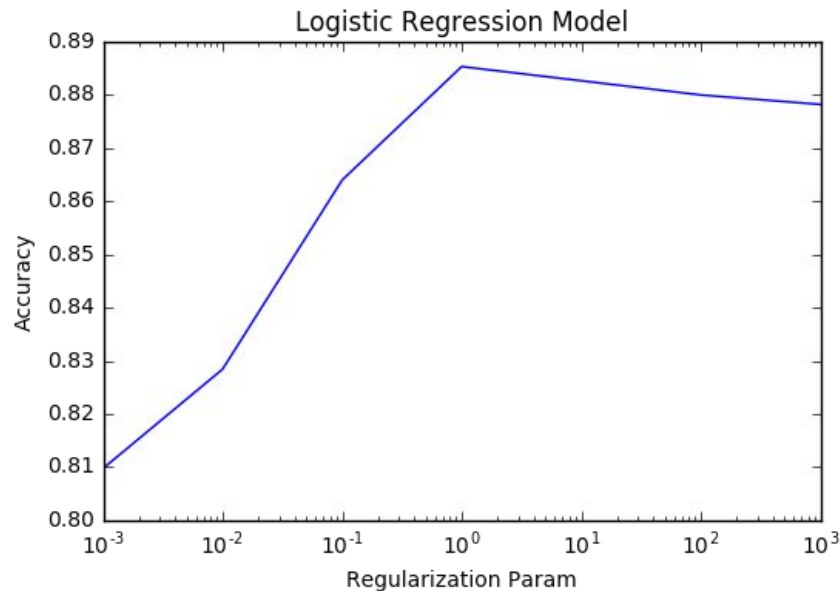
* actors casted in less than 10 movies are excluded from the list

Machine Learning Model

We chose a Logistic Regression model to help producers predict whether their next movie will be a success, based on:

- Title
- “Adult” movie or not
- Franchise or not
- Budget, adjusted for inflation
- Genre (action, romance, etc)
- Release Month

Accuracy for L2 Logistic Regression Model was >88%



Machine Learning Model Results

Logistic Model coefficients indicate which factors have the most effect on whether a movie is a blockbuster*

Increasing log odds: franchise, budget, animation, wedding, dragon... December, June

Decreasing log odds: war, next, wild, death, heaven, January, April

*defined as movies with at least 100M in income (revenue - budget) in our model. Definitions may vary from other sources

```
stack[stack[:,1].argsort()]
```

```
[u'about', u'0.0170200101120'],  
[u'Thriller', u'0.111225257869'],  
[u'07', u'0.183723083853'],  
[u'four', u'0.186070645337'],  
[u'movie', u'0.19862401239'],  
[u'Comedy', u'0.265058721344'],  
[u'king', u'0.287361474103'],  
[u'love', u'0.319195235147'],  
[u'06', u'0.374026574929'],  
[u'Family', u'0.401259603749'],  
[u'12', u'0.417430445917'],  
[u'kill', u'0.586455979785'],  
[u'Romance', u'0.612692589653'],  
[u'with', u'0.675149767802'],  
[u'dragon', u'0.805016905578'],  
[u'wedding', u'0.90339667866'],  
[u'Animation', u'1.11412856526'],  
[u'budget_adj', u'1.33789462611e-08'],  
[u'Franchise', u'1.54591126133']],  
dtype='<U32')]
```

```
stack[stack[:,1].argsort()]
```

```
[u'09', u'-0.325605602493'],  
[u'death', u'-0.346711506818'],  
[u'03', u'-0.362726006107'],  
[u'Action', u'-0.367460655877'],  
[u'Horror', u'-0.371909753977'],  
[u'space', u'-0.382798084625'],  
[u'04', u'-0.413441809567'],  
[u'boys', u'-0.420444318114'],  
[u'heaven', u'-0.438848597272'],  
[u'meet', u'-0.512960480947'],  
[u'legend', u'-0.588710115692'],  
[u'blue', u'-0.619316291634'],  
[u'01', u'-0.650842688166'],  
[u'life', u'-0.654408525991'],  
[u'dark', u'-1.07468133022'],  
[u'wild', u'-1.4051654451'],  
[u'next', u'-1.55507959666'],  
[u'War', u'-1.80026895421'],
```

Machine Learning Model Testing

When we enter **Jumanji** into the logistic regression model, it gives Jumanji only a 40% chance of being a blockbuster.

```
title  is_blockbuster  adult  Franchise  budget_adj  genre \
jumanji              1  FALSE              0  1.044501e+08  Adventure

runtime  release_month
104.0           12
```

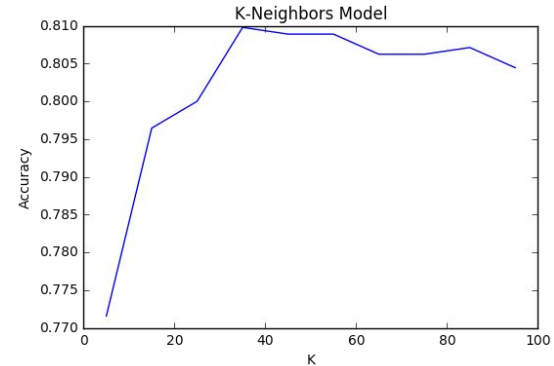
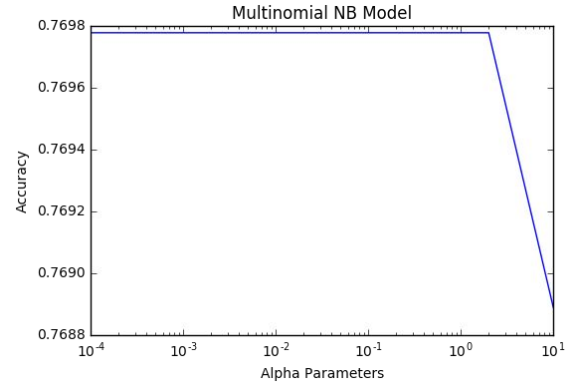
Model is still a bit too conservative-only 231/1125 test movies were blockbusters, but and the model predicted that there would be 182

```
[ 0.59593585  0.40406415]
```

Machine Learning Model Comparison

Multinomial Naive Bayes model was too aggressive, predicting that almost 300/1125 movies would be blockbusters

K-Nearest Neighbors Model was too conservative, predicting 139/1125 movies would be blockbusters



Scaling and Limitation

Scaling Strategies

1. Expanding dataset to global, non-English markets
2. Incorporating other sources of review data like Rotten Tomatoes
3. Incorporating other sources of revenue like video-on-demand sales
4. Analyzing live conversations on Twitter and other social media

Limitations

1. Lack of unobserved variables (e.g. creativity of plot, human values embodied in movies, acting skills) that can be highly relevant to movie revenue
2. Community-generated data can be infrequent and inconsistent
3. Lack of reporting on non-ticket (e.g. merchandise) revenue data

Q/A