BrainStation®

Stack Overflow Questions

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About me

- MSc in Civil Engineering
- Data Science Diploma
- +6 Years Experience in Structural Design
- Publication

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Probabilistic collapse assessment of steel frame structures considering the effects of soil-structure interaction and height

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KEYWORDS
Exceedance probability;
Fragility curve;
Incremental dynamic analysis;
Performance level;
Intermediate moment-resisting steel frame;
Soil-structure interaction.

Abstract. This paper investigates the seismic performance of intermediate moment-resisting steel frame structures considering the effects of height and soil-structure interaction. For this purpose, three 3D structures of 3-, 6-, and 9-story buildings were designed using CSI ETABS software in accordance with ASCE7-16. Then, the 2D frames of the structures were simulated by OpenSees software and to account for the nonlinearity of the material, the plastic hinge elements were used. The 2D frames were analyzed using Incremental Dynamic Analysis (IDA) method subjected to 22 far-field ground motion records of FEMA-P695. Finally, the fragility curves of the structures were developed. The results illustrated that consideration of soil-structure interaction led to lower spectral acceleration as height increased, meaning that higher-rising structures had record-induced $S_{a(T1,5\%)}$ closer to $S_{a(\text{Design})}$ and upon decreasing height, the difference tended to increase. Exceedance probability decreased with increase in the structure's height, and consideration of the soil-structure interaction adapts to lower exceedance probability. Moreover, the investigated intermediate moment-resisting steel frame structural models designed according to ASCE7-16 consideration exhibited acceptable seismic performance against far-field records. Their exceedance probabilities in terms of Life Safety (LS) and Collapse Prevention (CP) performance levels are less than 0.45 and 0.03, respectively.

Introduction

- Problem Statement
- Business Value

  Questions can be closed:
  - Duplication
  - Off-topic or not related to programming
  - Lack of detail in the question
  - Not a real question

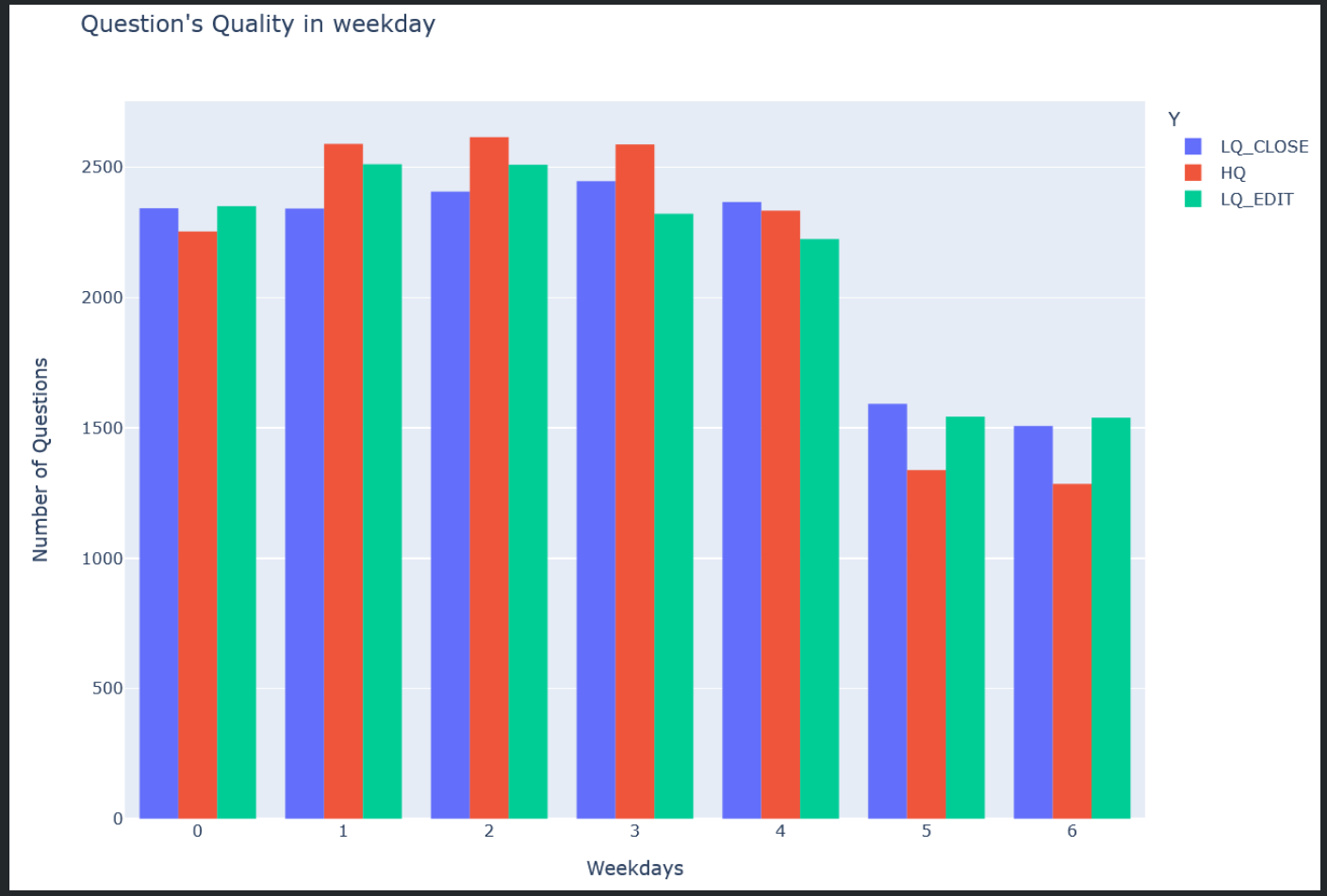
Data Description

	Id	Title	Body	Tags	CreationDate	Y
0	34552974	How to get all the child records from differen...	I am having 4 different tables like \r\nselect...	<sql><sql-server>	2016-01-01 01:44:52	LQ_EDIT
1	34554721	Retrieve all except some data of the another t...	I have two table m_master and tbl_appointment\...	<php><mysql><sql><codeigniter><mysqli>	2016-01-01 08:43:50	LQ_EDIT
2	34555135	Pandas: read_html	<p>I'm trying to extract US states from wiki U...	<python><pandas>	2016-01-01 09:55:22	HQ
3	34555448	Reader Always gimme NULL	I'm so new to C#, I wanna make an application ...	<sql-server><c#-4.0>	2016-01-01 10:43:45	LQ_EDIT
4	34555752	php rearrange array elements based on condition	basically i have this array:\r\n\r\n array(...	<php>	2016-01-01 11:34:09	LQ_EDIT

Feature Engineering

Weekday

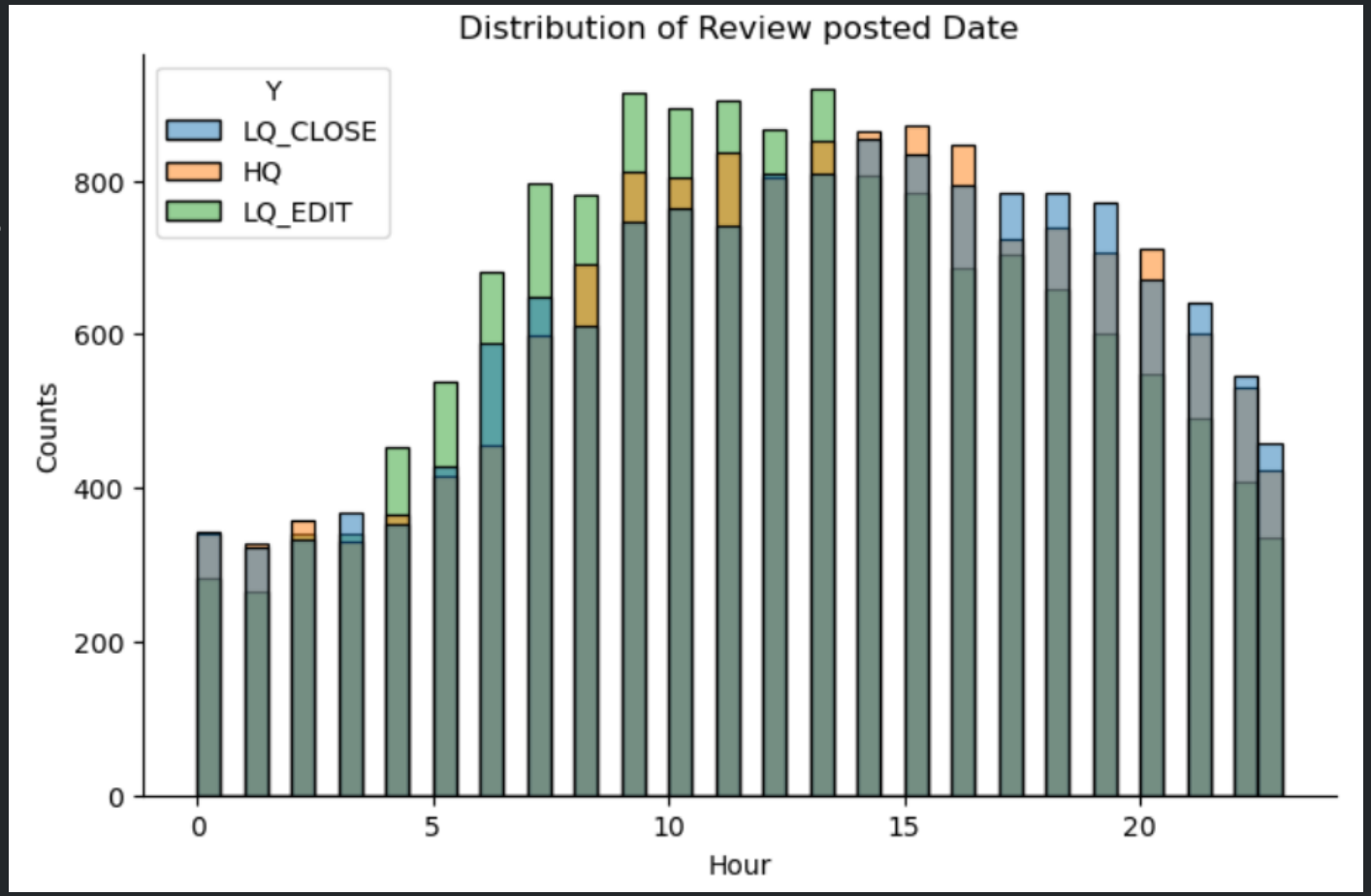
- Users created more questions at weekdays comparing to weekends.
- At weekends, the portion of high-quality questions was the lowest.



Hour

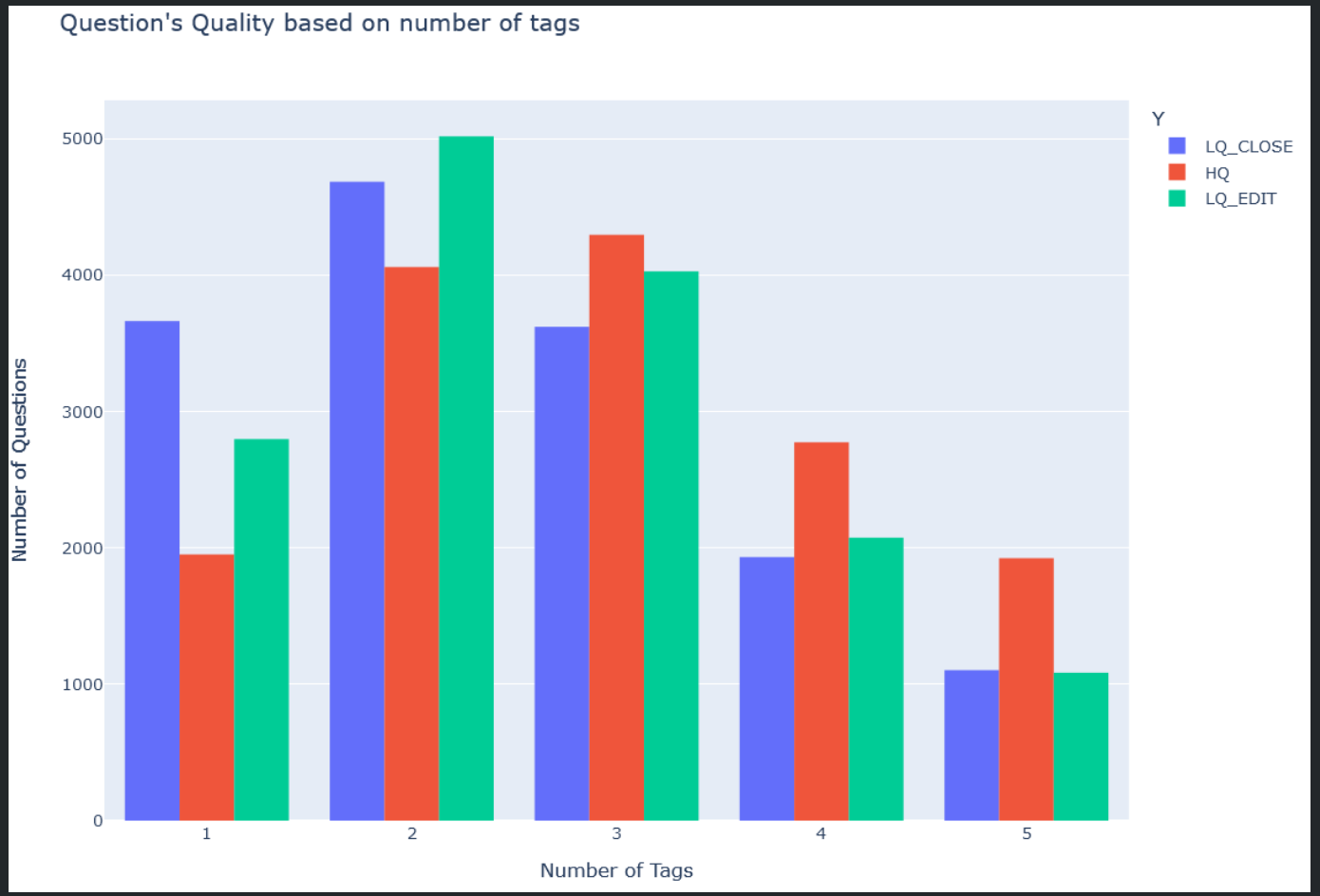
- Most of the questions were created between 10am – 2pm.

- Questions created at nights were more likely to be closed. (The blue colors on top)



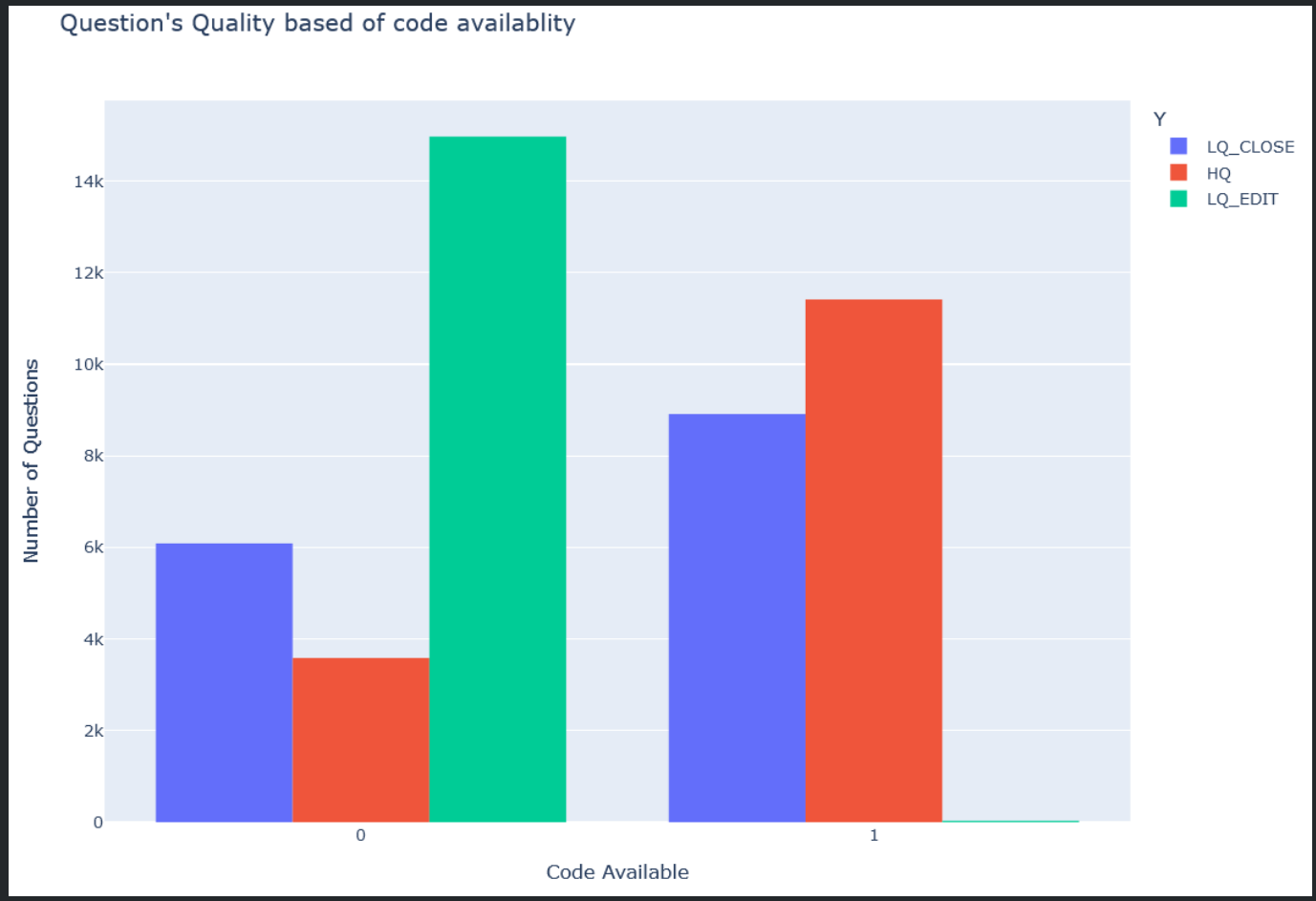
Number of Tags

- Most questions had 2 tags.
- The more number of tags we have, the greater chance to have a high-quality question.

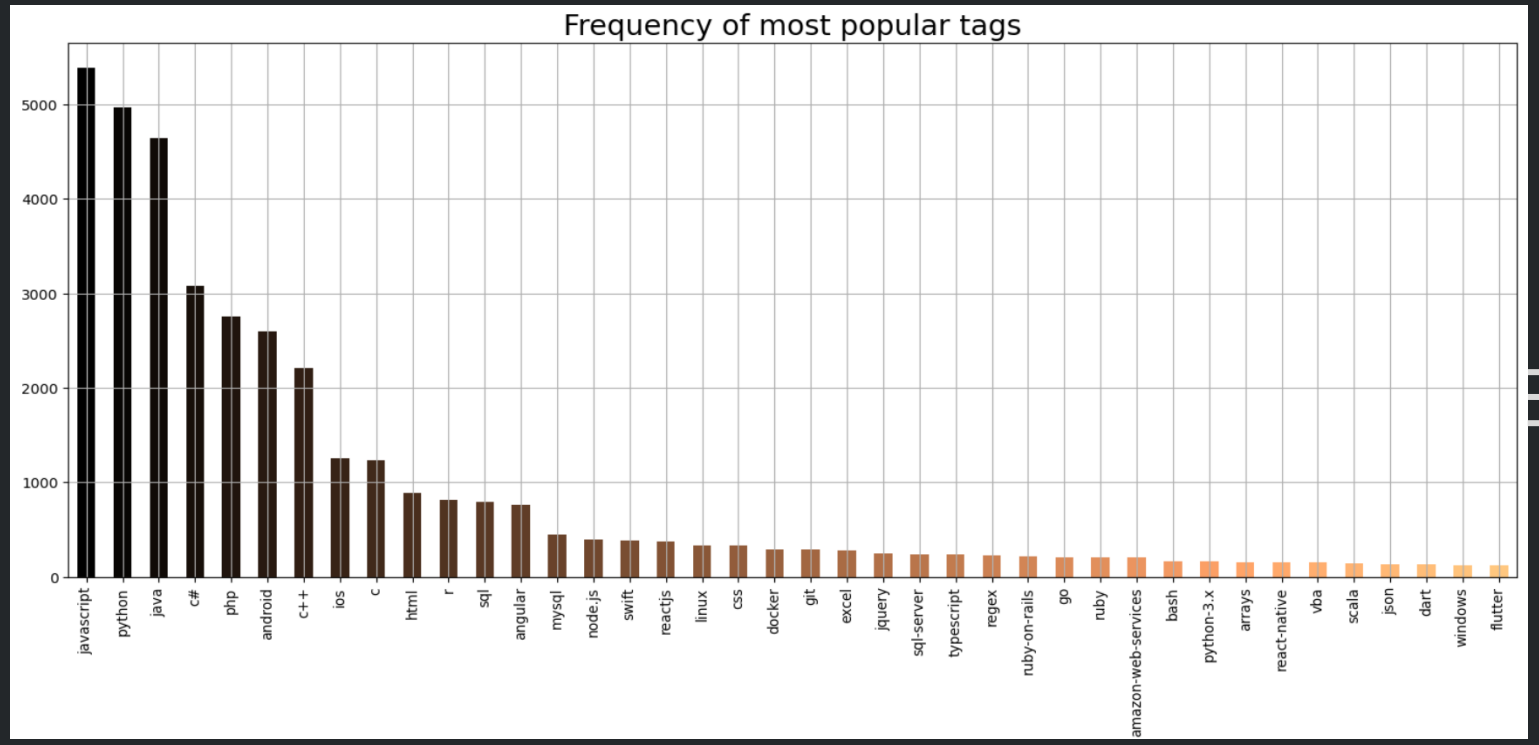


Code Availability

- More than half of our questions did not have any codes.
- When we have code in our question, the chance of having a High-Quality question is the highest.
- Code Availability is a decisive factor.

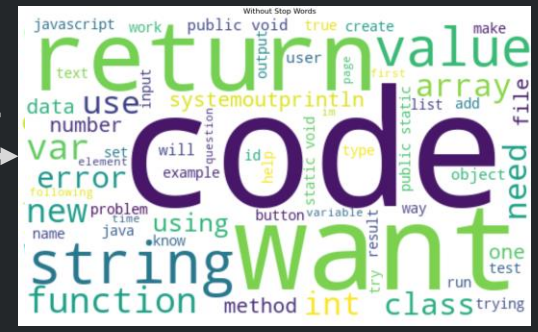


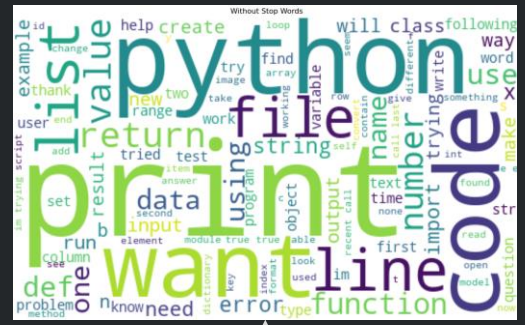
Popular Tags



JavaScript

Java





Python

Final Dataset

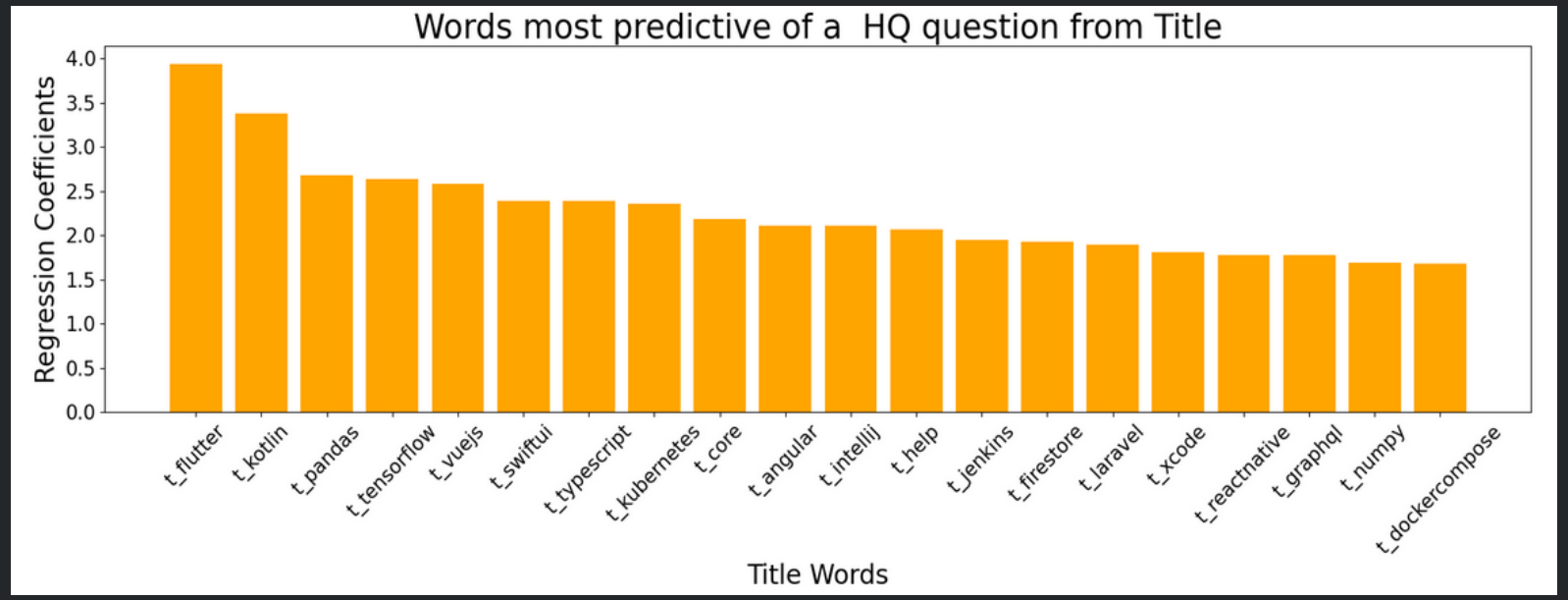
- TF – IDF Vectorization
- 2018 Columns

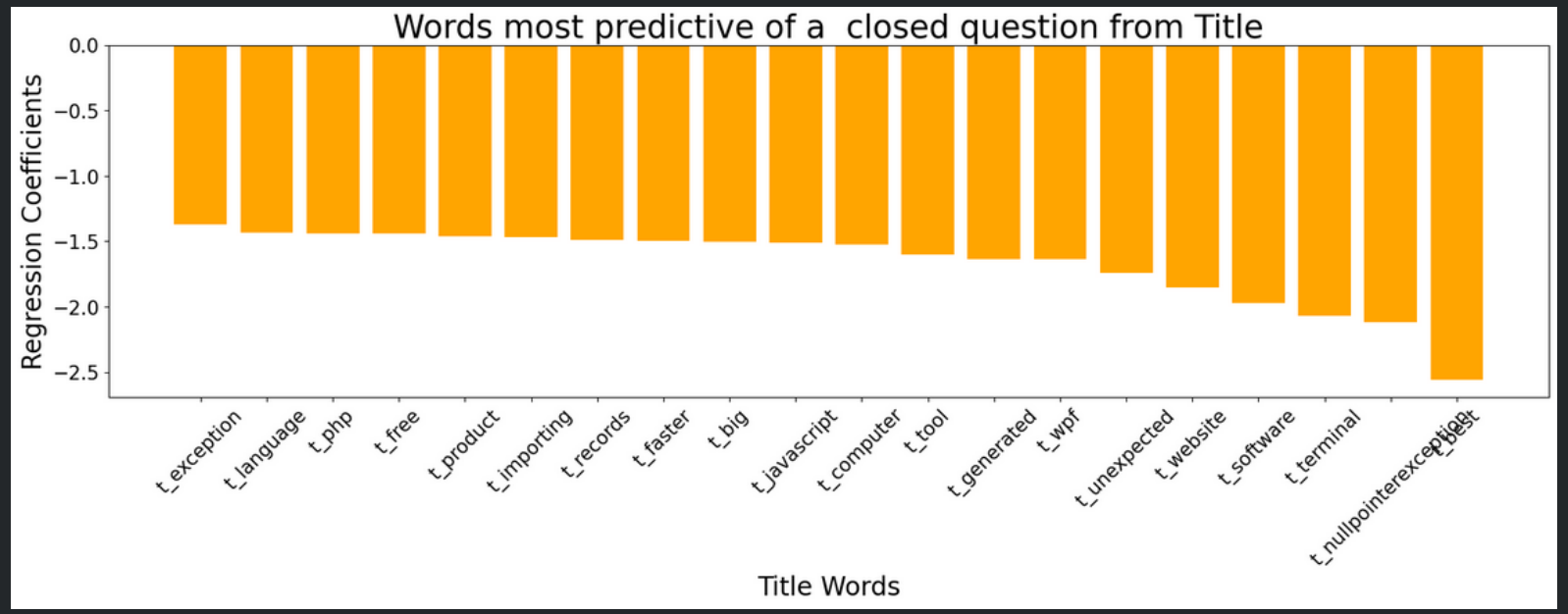
on_Hour	Creation_Weekday	Creation_Month	Creation_Year	Body_Avg_Word_Length	Title_Avg_Word_Length	Body_Num_Of_Words	Title_Num_Of_Words	Nu
18	3	11	2016	5.166667	5.000000	30	6	
10	0	9	2017	4.888889	4.777778	18	9	
16	3	7	2016	7.000000	5.000000	27	5	
9	4	3	2016	18.236842	5.000000	38	3	
13	6	10	2018	15.800000	8.333333	25	3	
...	...	...	...	...	...	...	...	
19	2	4	2019	3.613433	7.333333	670	3	
3	4	4	2018	4.865385	6.166667	104	6	
13	1	5	2017	7.335260	6.166667	173	6	
16	0	12	2018	3.928571	7.000000	42	5	
22	2	11	2018	3.046875	5.800000	384	5	

2018 columns

Title

- Titles mostly 4-6 words.
- Advanced, technical words predictive of HQ titles.
- Top 20 closed Qs use general words; HQ Qs use advanced words.
- Shorter, fewer words = higher chance of closed Qs.





Models

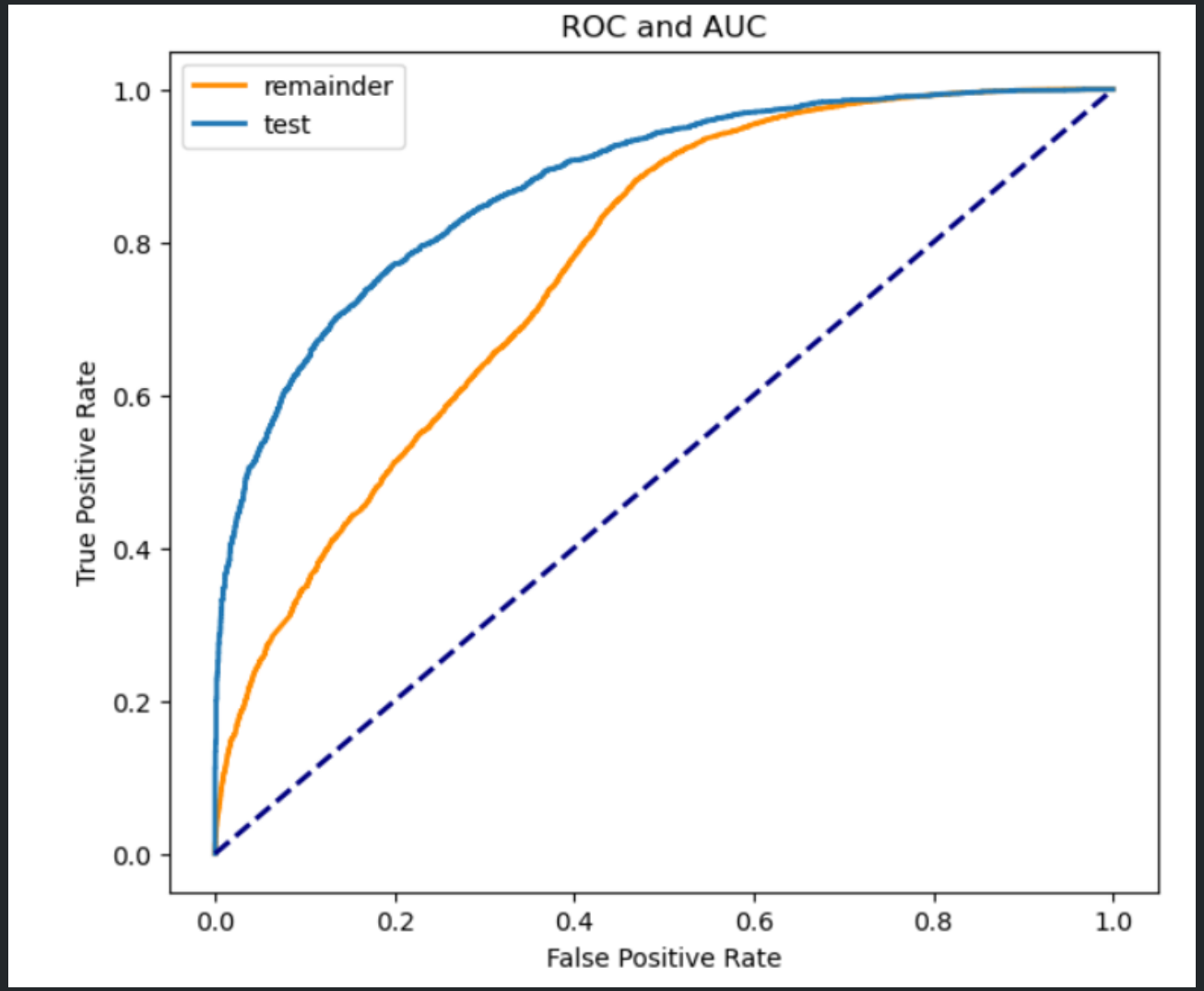
Models	Test Score	Train Score	Parameters
Logistic Regression	75%	77.31%	C_Value = 0.1
SVM	75.25%	83%	C_Value=0.01
Random Forrest	73%	84%	max_depth=21 n_est=13
XGBoost	79%	84.6%	max_depth=6 n_est=40
ANN	70.5%	-	-
Multi Class NNs	79%	-	More complex

Closing Remarks

- Out of 100 questions, 88 of them will be predicted correctly as a HQ question.

Test AUC Score: 0.88

Remainder AUC Score: 0.78



Next Steps

- Search for less biased data.
- Conduct a Word Embedding analysis.
- Explore more advanced NLP Models.
- Run an extensive ML Pipeline with GridSearch via AWS.
- Develop an API to predict the quality rating of the questions.

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Data Science Alumnus at BrainStation | Experience in Web Development and UI / UX Design | Proficient in...