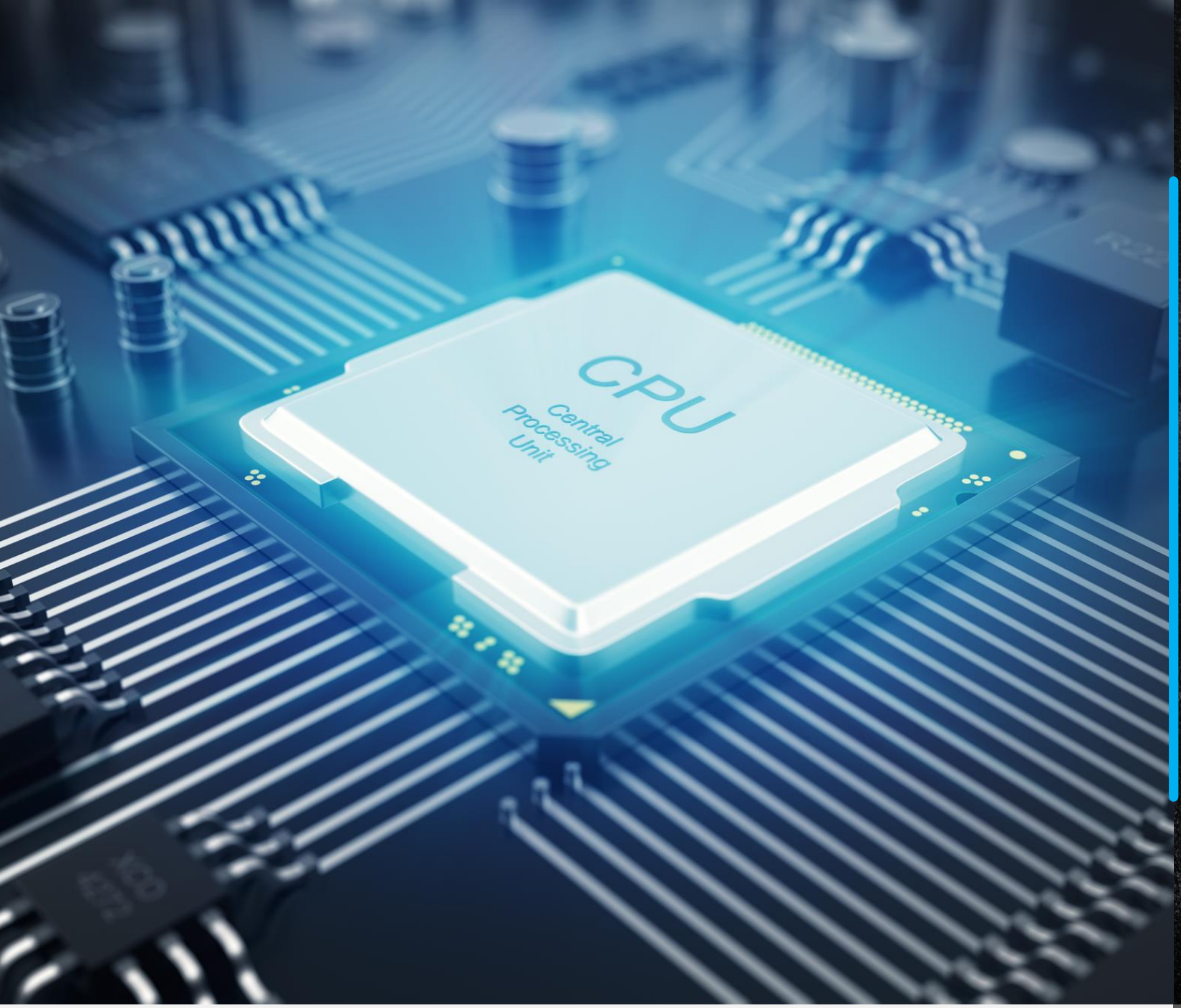

Using Natural Language Processing (NLP) Modelling to Predict Desktop CPU Brand Popularity

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SG-DSI-27

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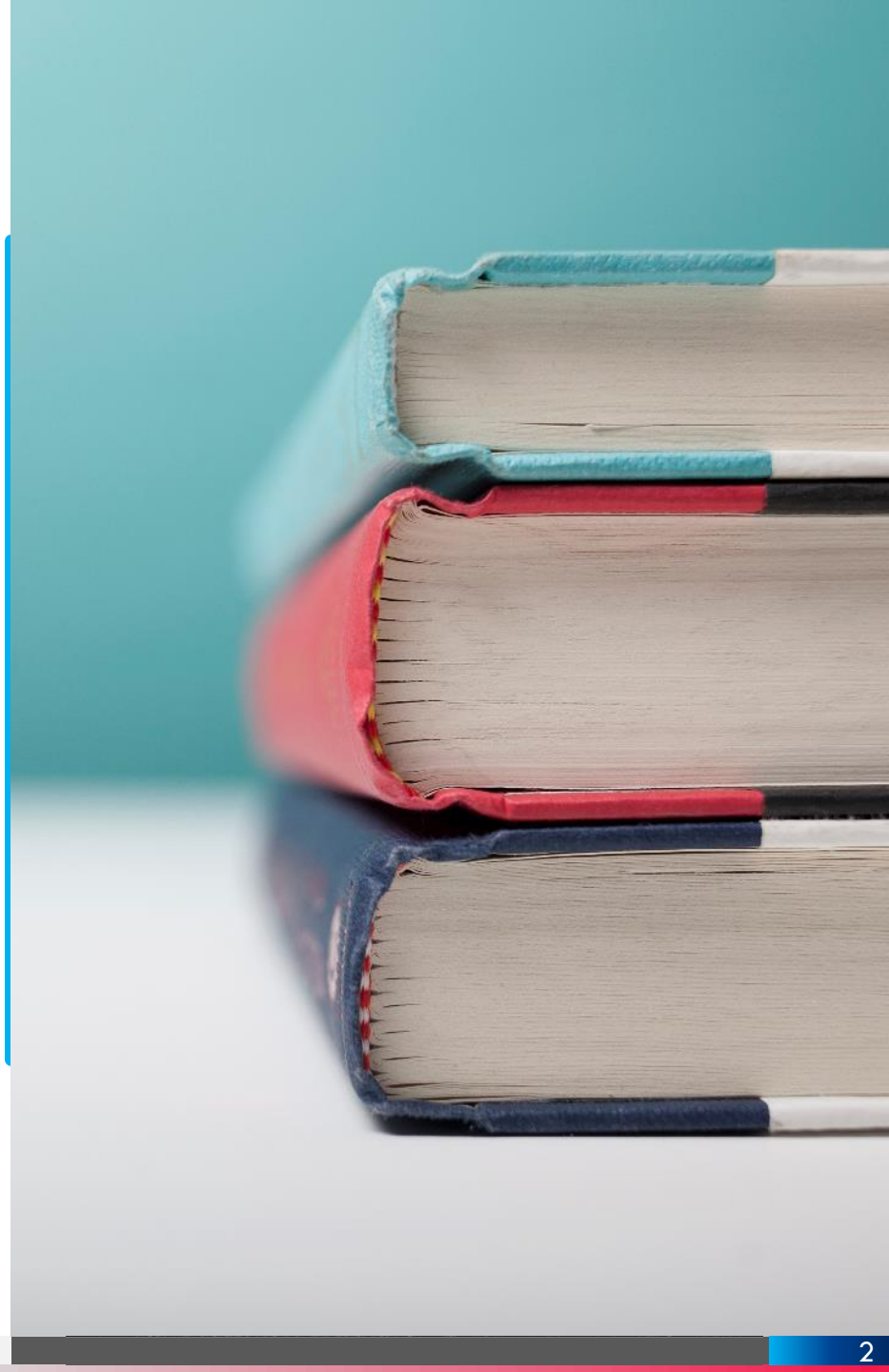


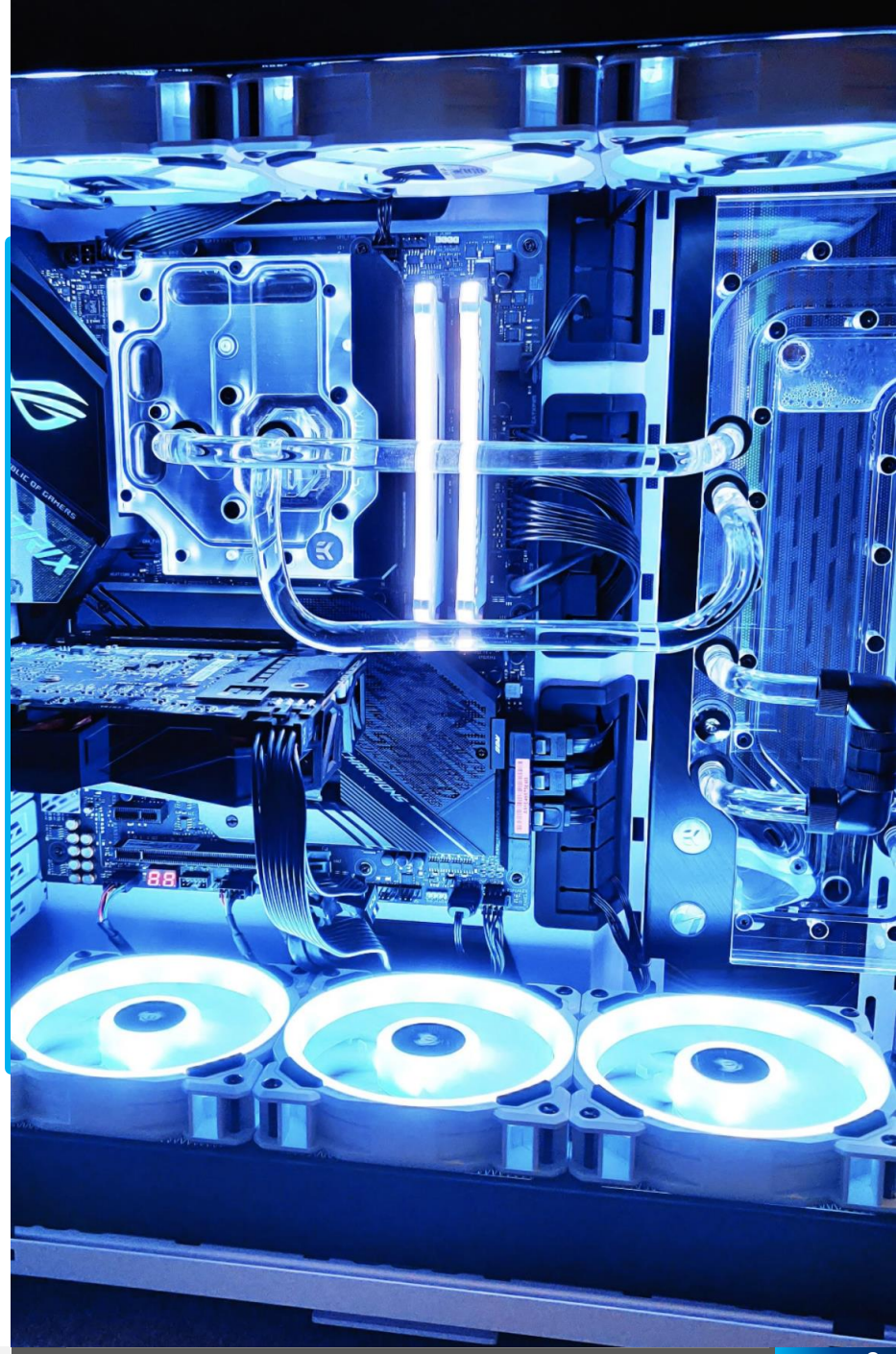
Background

Problem Statement

As an aspiring entrepreneur embarking on a new custom Gaming/Enthusiast Desktop PC startup, which desktop CPU brand should I carry to minimize dead stock/ slow moving inventory?

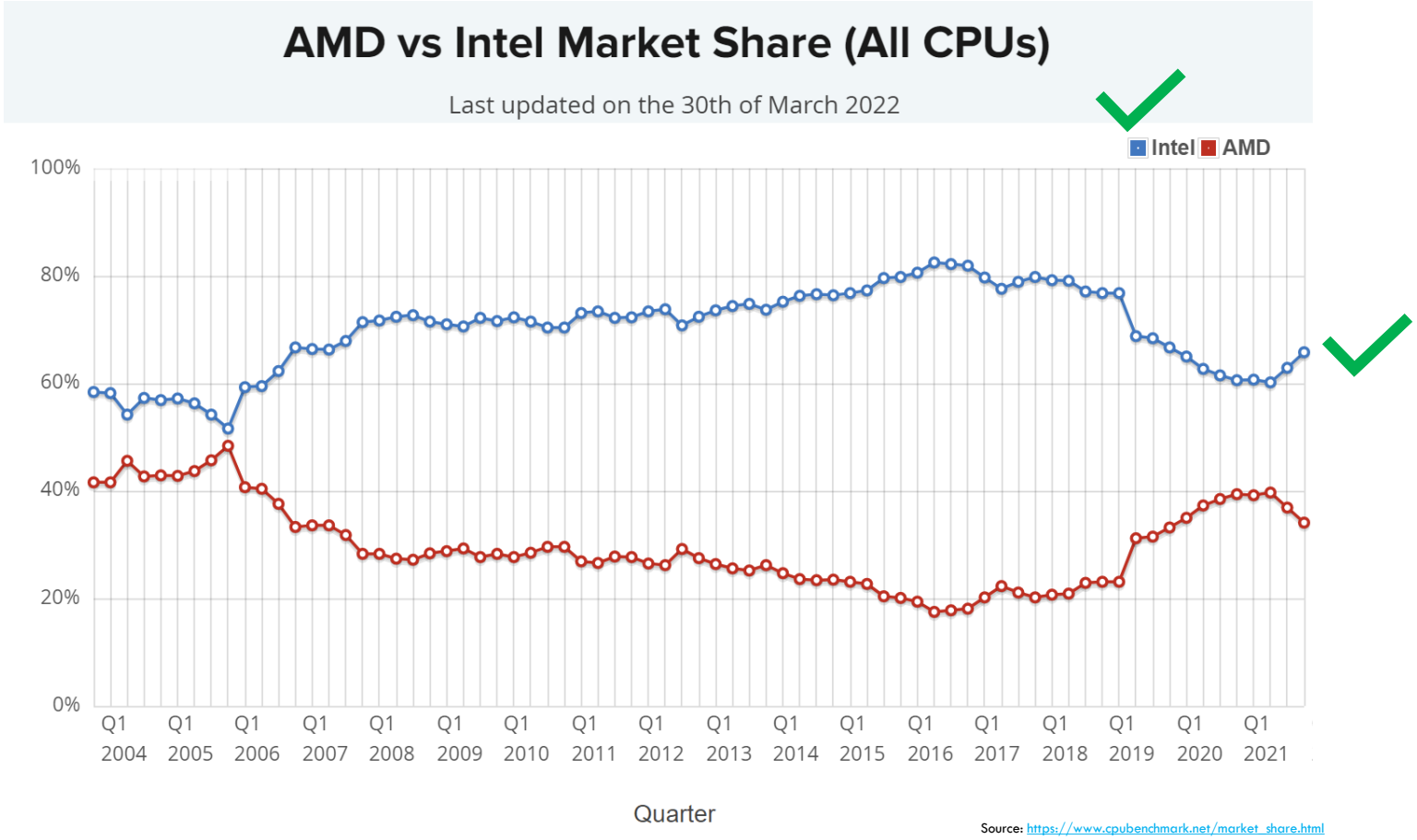
Key Considerations

- Low initial capital
  - Parts brought in need to be quickly sold to obtain more funds to grow the business.
- AMD vs. Intel in the PC Hardware Ecosystem
  - Choice of CPU brand will dictate other parts like motherboard, DRAM etc. and are not interchangeable.
- Target market group
  - PC Gamers and Enthusiasts (PC Master Race)



Background

AMD vs. Intel (All CPUs)



BUT! Include Server, Laptop, Desktop CPUs for both Consumer and Enterprise customers

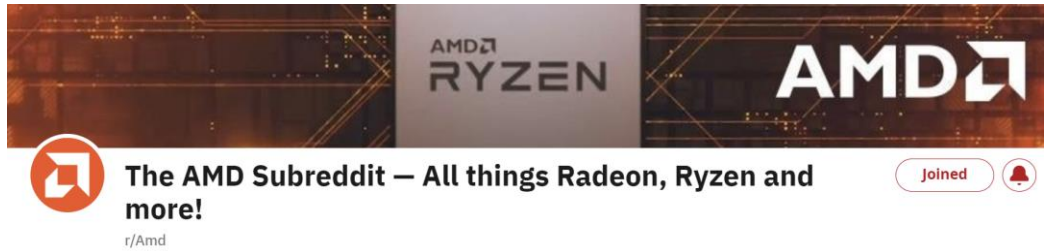
How then can I know which CPU brand to choose?

NLP Model Training

Overview

10,000 posts each from r/AMD and r/Intel were scraped to train the model.

r/AMD



r/Intel

10,000 posts from r/BuildaPC will be used to quantify which brand is more popular.

Example Post:

r/buildapc · Posted by u/thecerealkidd 32 minutes ago

Is a 550w Corsair RM550x enough to run a Zotac RTX 3060Ti Twin Edge OC?

Build Upgrade

I'm looking to upgrade my GPU to a 3060ti but I'm not sure if my current PSU can run it without any hiccups. My full system specs are:

Processor: Ryzen 5 5600x
CPU Cooler: Arctic Freezer 34 Esports Duo
Motherboard: MSI B450m Bazooka Plus
RAM: 16gb 3200mhz ddr4 (Dual Channel)
Storage: 240GB NVMe SSD and 2TB HDD
GPU: Palit GTX 1050 2GB
PSU: Corsair RM550x

Thanks for the feedback!!

Data Cleaning

Subreddits r/AMD vs. r/Intel

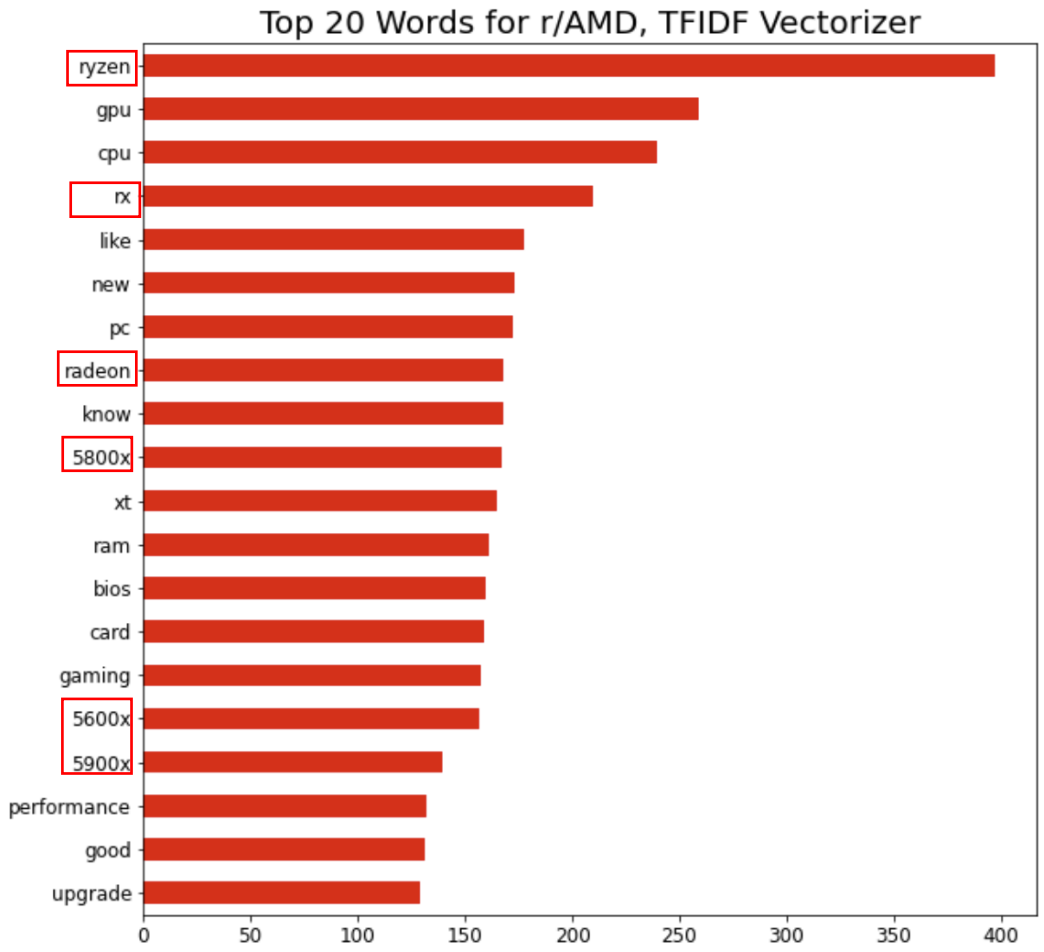
Following was done to clean the reddit title and posts:

1. Links were removed from the posts. Regex selector = r"http.:+[^\s]+[\w]“.
2. Markdown codes such as ‘’, ‘<’, ‘>’, /n were removed.
3. Common words were excluded from model using the spaCy (https://spacy.io/) list of English stop-words.
4. Dead giveaway words like AMD and Intel were excluded as well.
5. Reddit posts and titles were merged into one ‘Text’ column.

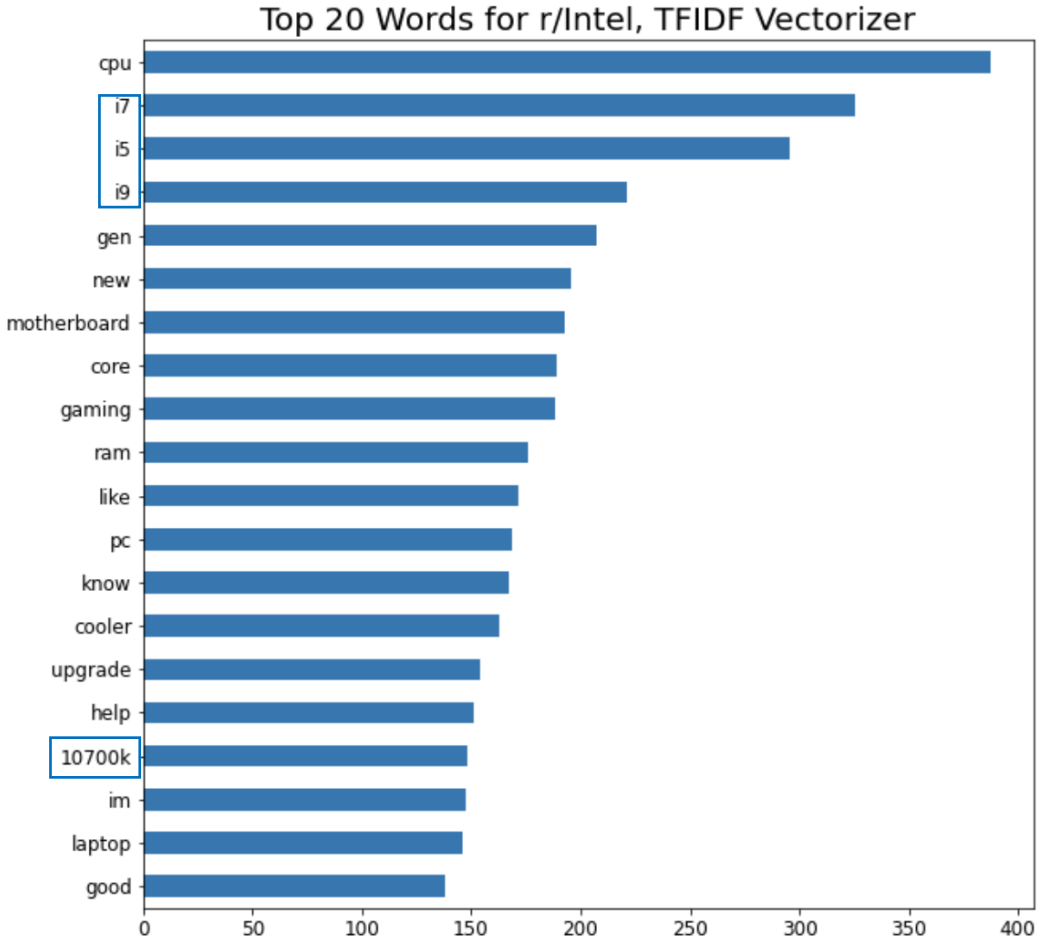
Exploratory Data Analysis

Comparing Top Words

r/AMD



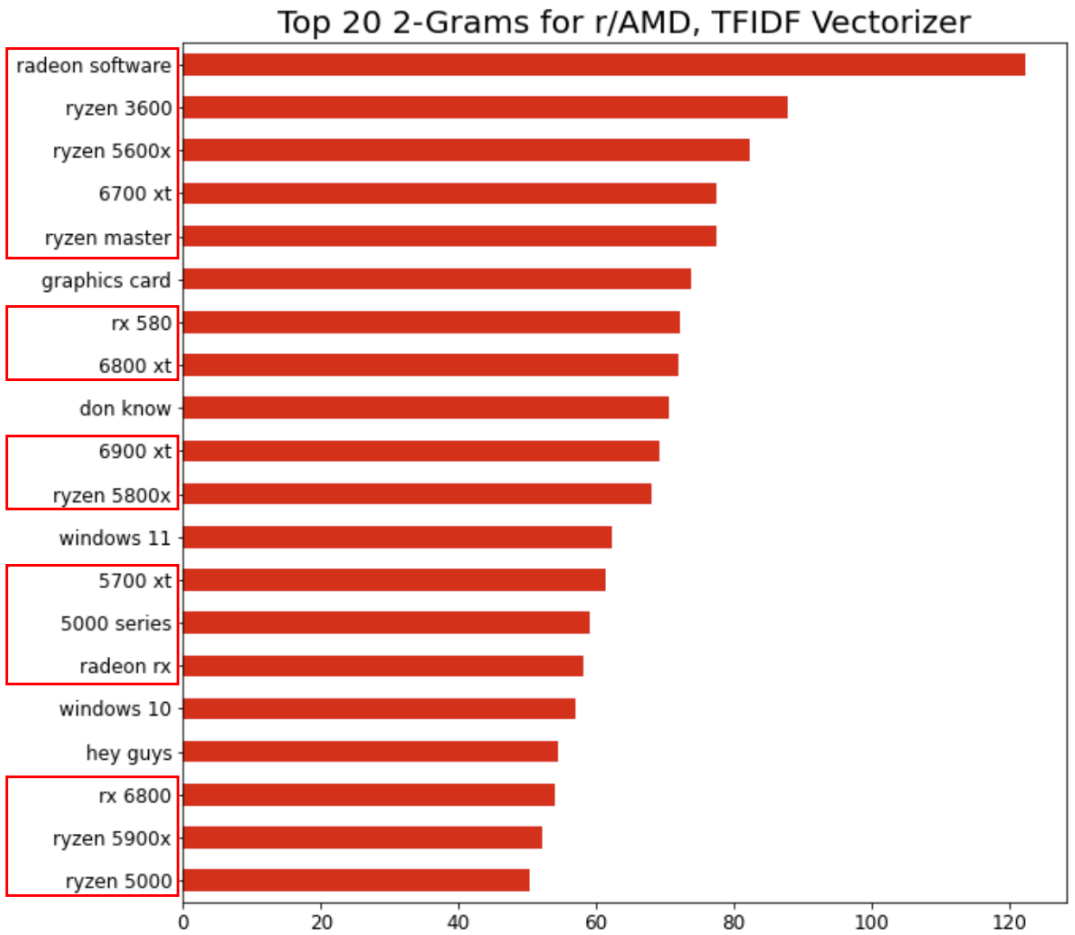
r/Intel



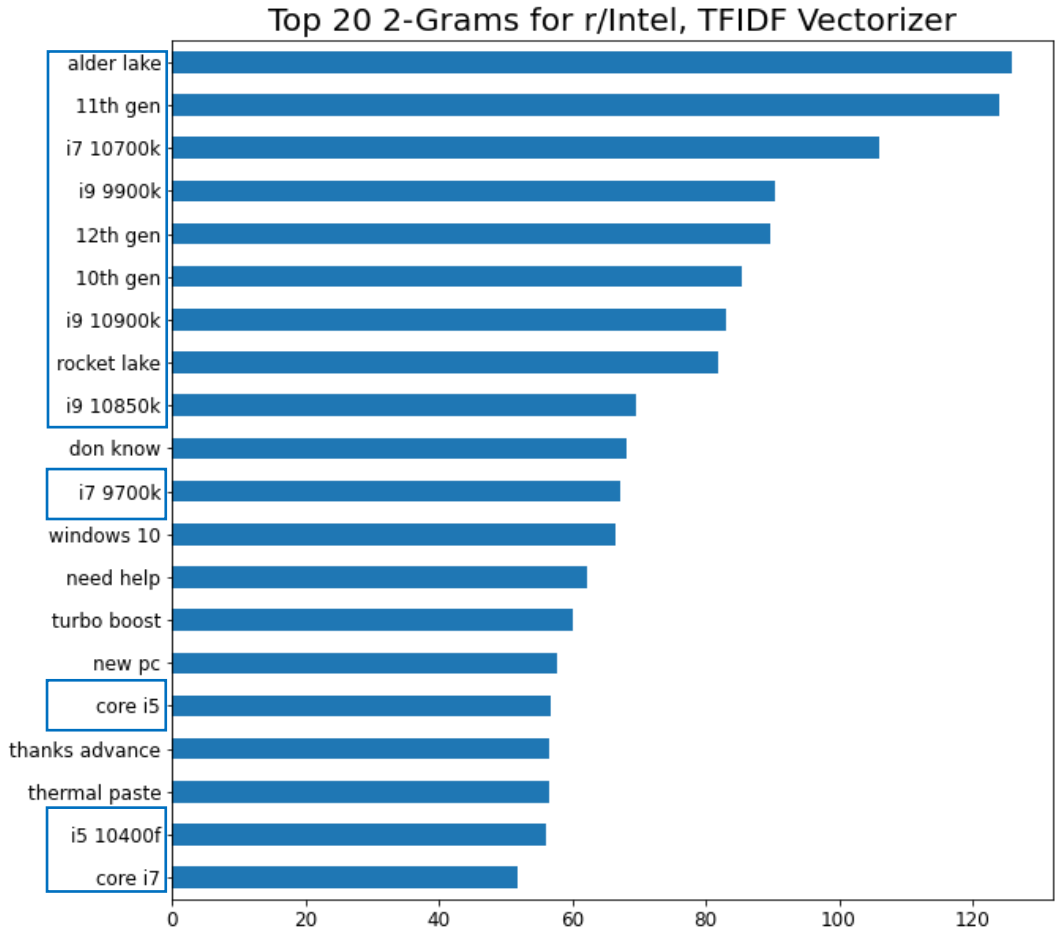
Exploratory Data Analysis

Comparing Top Bigrams

r/AMD



r/Intel



Base Model Benchmarking and Selection

Parameters

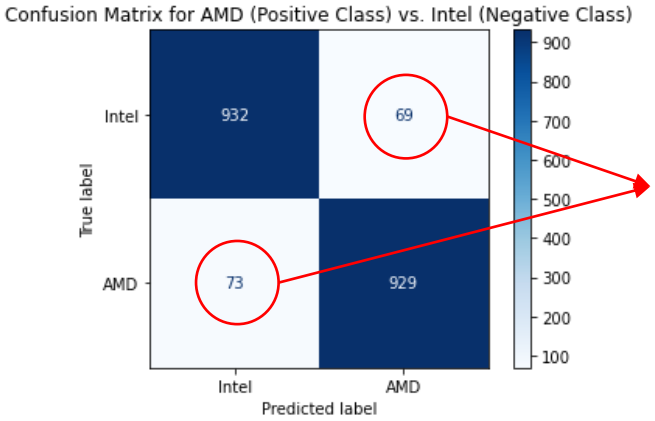
Vectorizers	CountVectorizer()	'max_features': [5000],
		'n_gram_range': [(1,1)]
	TfidfVectorizer()	'stop_words' : [new_spacy],
Classifiers	LogisticRegression()	Default
	MultinomialNB()	
	RandomForestClassifier()	

Model Performance

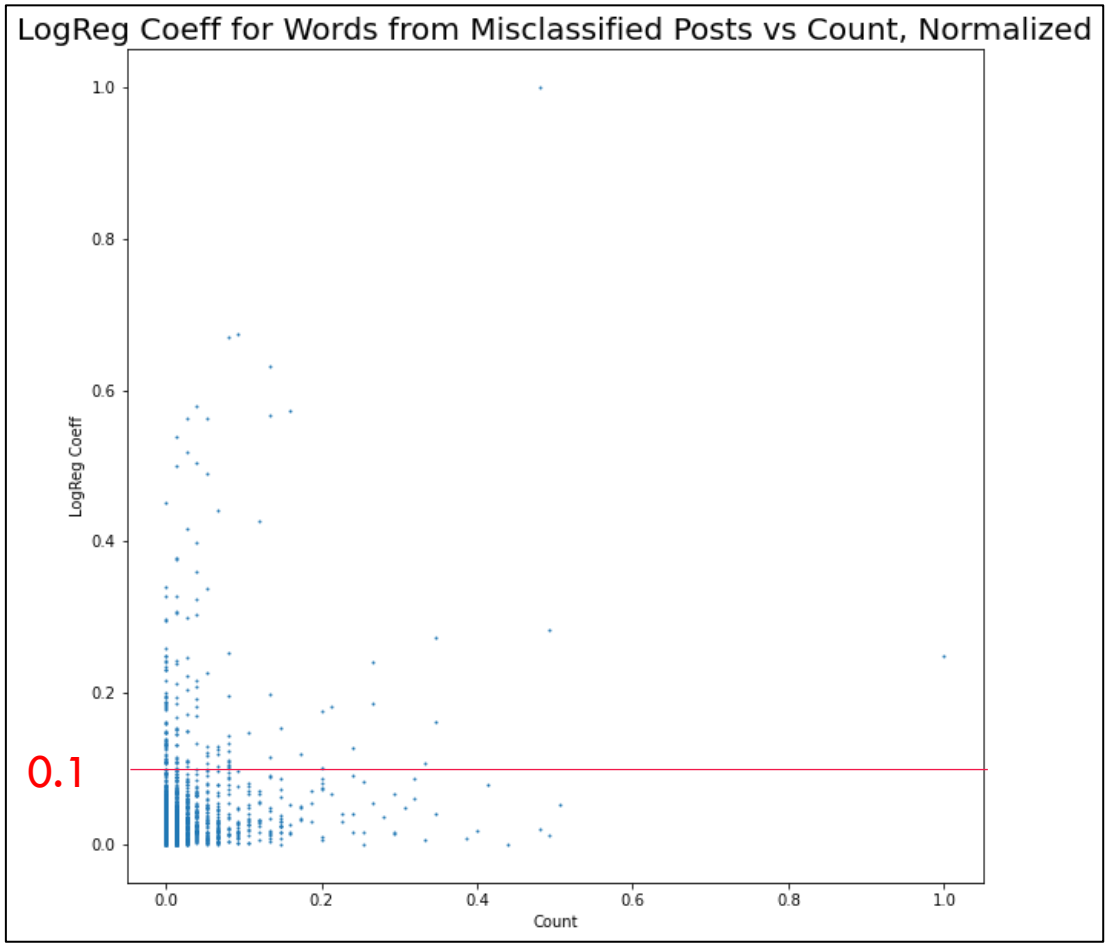
		Accuracy Score		
Vectorizer	**Classifier**	**Cross-Val Score**	**Train Score**	**Test Score**
CountVectorizer(stop_words=['amd', 'intel'])	**LogisticRegression()**	**91.58%**	**98.62%**	**91.66%**
CountVectorizer(stop_words=['amd', 'intel'] + spaCy))	LogisticRegression()	91.95%	98.51%	92.21%
CountVectorizer(stop_words=['amd', 'intel'] + spaCy]))	MultinomialNB()	91.42%	92.86%	91.06%
CountVectorizer(stop_words=['amd', 'intel'] + spaCy))	RandomForestClassifier()	92.11%	99.87%	91.96%
TfidfVectorizer(stop_words=['amd', 'intel'] + spaCy))	**LogisticRegression()**	**92.74%**	**95.71%**	**92.91%**
TfidfVectorizer(stop_words=['amd', 'intel'] + spaCy))	MultinomialNB()	91.00%	92.58%	91.51%
TfidfVectorizer(stop_words=['amd', 'intel'] + spaCy))	RandomForestClassifier()	91.94%	99.87%	92.46%

+1.25%

Feature Engineering



Tokenized



E.g. Words Dropped from Model	
Numbers	12
	120
	1200
Non-Descriptive	add
	experience
	feel
	hard
Other Brands	youtube
	creative
	crucial
	evga

		Accuracy Score		
Vectorizer	**Classifier**	**Cross-Val Score**	**Train Score**	**Test Score**
TfidfVectorizer(stop_words=['amd', 'intel'] + spaCy)	LogisticRegression()	92.74%	95.71%	92.91%
TfidfVectorizer() w/ added Stop-Words	LogisticRegression()	93.41%	96.20%	93.11%

+0.20%

Hyperparameter Tuning

Hyperparameters Tuned

Vectorizers	TfidfVectorizer()	**'max_features':** [5000, 10_000, 20_000, 30_000, 40_000, 50_000]
		'n_gram_range': [(1,1), (1,2), (1,3)],
		'tvec__max_df': np.linspace(0.9,1.0,6)
		'tvec__min_df': np.linspace(1,10,10)
Classifiers	LogisticRegression()	**'lr__C':** np.linspace(0.001,1,11)
		'lr__solver': ['saga'], 'lr__penalty': ['elasticnet'], **'lr__l1_ratio':** np.linspace(0, 1, 11)

		Accuracy Score			
Vectorizer	**Classifier**	**Cross-Val Score**	**Train Score**	**Test Score**	**Hyperparameters**
TfidfVectorizer() w/ added Stop-Words	LogisticRegression()	93.41%	96.20%	93.11%	'tvec__max_features' = 5_000, 'tvec__n_gram_range' = (1,1)
TfidfVectorizer() w/ added Stop-Words	LogisticRegression()	93.56%	96.83%	93.71%	'tvec__max_features' = 30_000, 'tvec__n_gram_range' = (1,1), 'lr__C': 1.0

+0.60%

Production Model

Production Model Performance

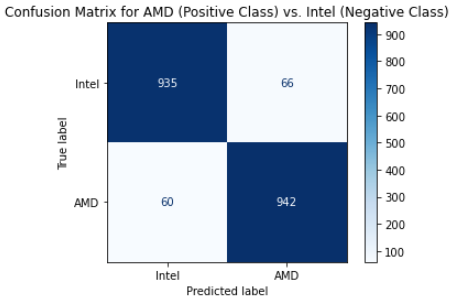
		Accuracy Score			
Vectorizer	**Classifier**	**Cross-Val Score**	**Train Score**	**Test Score**	**Hyperparameters**
CountVectorizer(stop_words=['amd', 'intel'])	LogisticRegression()	91.58%	98.62%	91.66%	Default
TfidfVectorizer() w/ added Stop-Words	LogisticRegression()	93.56%	96.83%	93.71%	'tvec__max_features' = 30_000, 'tvec__n_gram_range' = (1,1), 'lr__C': 1.0

+2.05%

Word	LogReg Coeff
ryzen	10.0
5800x	6.4
5900x	6.1
x570	5.8
radeon	5.6
rx	5.3
5600x	5.3
xt	5.0
5950x	5.0
6900xt	4.7
b550	4.6
6800xt	4.4
pbo	4.2
6700xt	4.1
fsr	3.7
21	3.5
r5	3.3
vega	3.3
5600g	3.3

Word	LogReg Coeff
i7	-9.3
i5	-8.1
10900k	-6.8
i9	-6.5
10700k	-6.2
z490	-6.2
12900k	-5.4
i3	-5.0
z690	-5.0
lake	-4.5
9900k	-4.4
10850k	-4.3
12700k	-4.0
10600k	-3.9
12600k	-3.9
optane	-3.5
xeon	-3.4
xe	-3.3
uhd	-3.2

Production Model Error Analysis



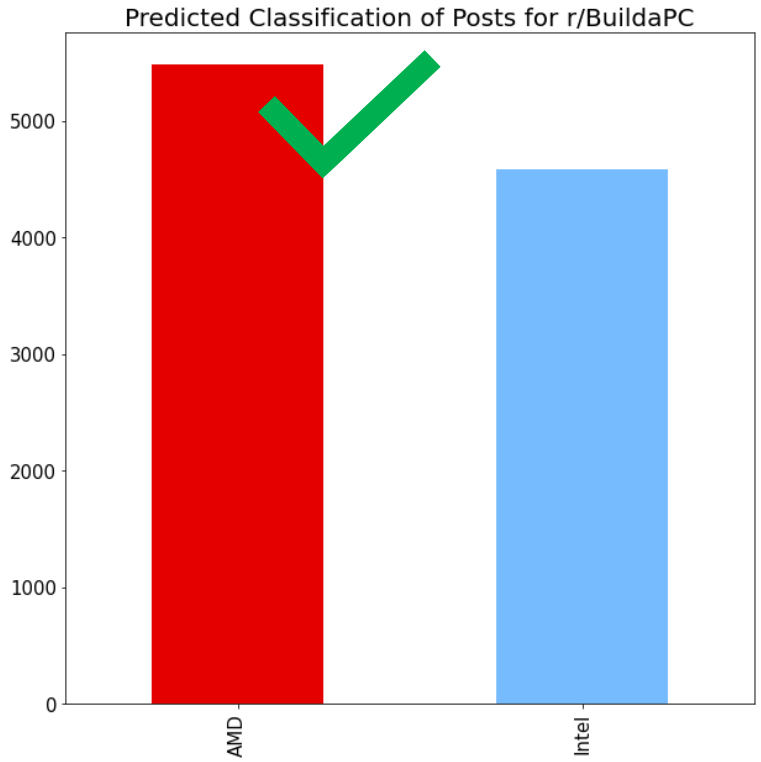
Error Analysis on Misclassified Posts

Misclassification Category	Example of Post
Comparison post between AMD products vs Intel Products	"which would you choose between a ryzen 5800x and a 10850k? looking for the best gaming performance and futureproof (not looking to upgrade CPU in the next 3-4years), which option would be the best for me?"
General post that can be applicable to both AMD/Intel	"What do you call Intel's way of advertising? Its for my essay I forgot what its called when they showcase their new products on the stage and a lot of people are watching? is there a term to call this?"
Posts that don't talk about the products at all	“Honestly, this is a way better sub than /r/AMD The difference between this sub and /r/AMD , is that you can criticize Intel here and you won't immediately be called shill, gaslighted or told that you're spreading FUD. Whereas any criticism of AMD anywhere elicits an immediate attacking and scathing response from AMD fanboys, who seem to be extremely insecure.”

Production Model Deployment and Recommendations

Deploying on r/BuildaPC

		Accuracy Score		
Vectorizer	**Classifier**	**Cross-Val Score**	**Train Score**	**Hyperparameters**
TfidfVectorizer() w/ added Stop-Words	LogisticRegression()	93.04%	96.82%	'tvec__max_features' = 20_000, 'tvec__n_gram_range' = (1,1), 'lr__C': 1.0



Therefore, I will be choosing to carry **AMD** CPUs for my custom PC building startup.

Conclusion

Project Conclusion

Although Intel has a higher market share overall, when we zoom in to our Target Market, AMD is the CPU Brand of choice.

A few ways to go about increasing accuracy within the current scope of the tools used in this project is:

1) Deep-dive into Stopwords engineering to remove more words with low feature importance.
2) Hyperparameter tuning for all models since some can perform better if tuned properly.

Possible Future Works

- Run sentiment analysis to see whether posts are positive or negative against AMD and Intel.
- Do multiclass classification for the GPU market (Nvidia RTX, AMD Radeon, Intel Arc) to see which GPU brand I should carry.
- Automate the process so that frequent market analysis can be done in order to update the business strategy.

Thank You

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