

E-Commerce Shipment On-Time Delivery



Agenda

01 Business Problem

02 Exploratory Data Analysis

03 Predictive Modeling

04 Conclusions

05 Recommendation

06 Next Steps



01

Business Problem

The company has experienced decline in customer satisfaction at one of its major distribution centers due to excessive late deliveries.

We are charged with:

- Analyze the shipping data to find root cause of lateness.
- Create a model to predict if a shipment will be late, so that the company can preemptively take corrective action.



02

Data Analysis

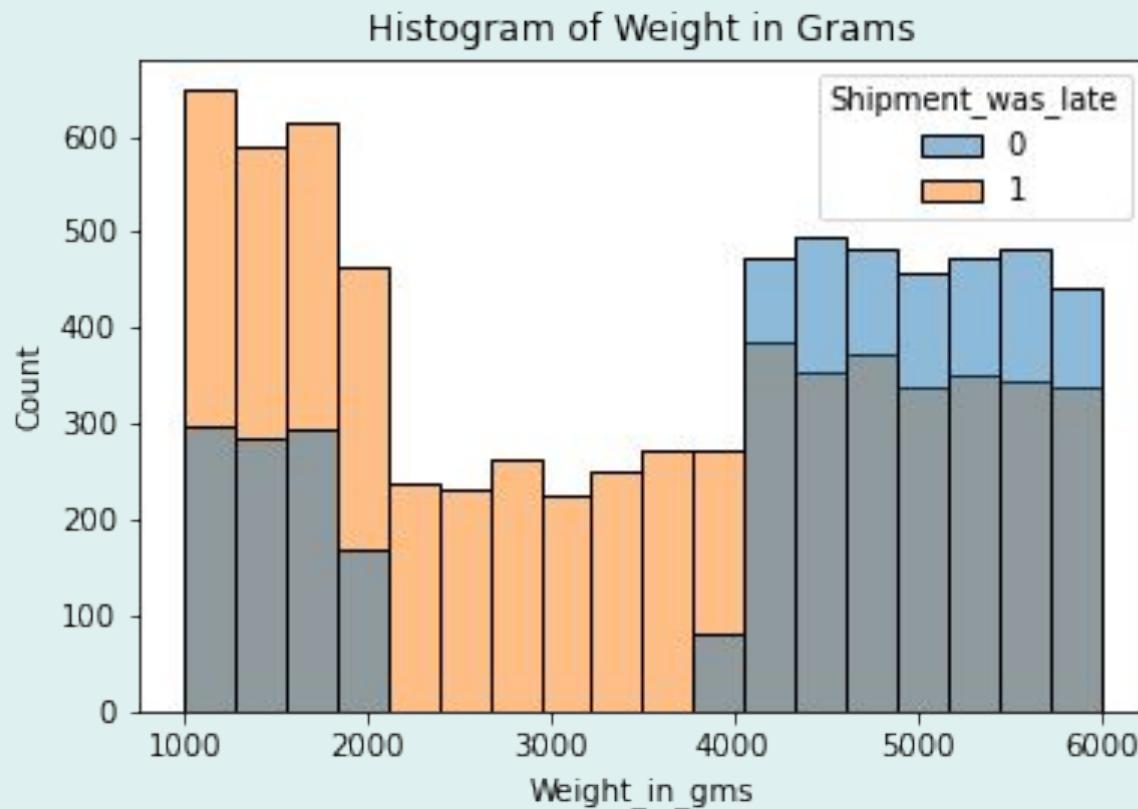
The dataset used in this analysis contained records of 11,000 shipments, including details regarding:

- Warehouse block
- Mode of shipment
- Customer care calls
- Customer rating
- Cost of the product
- Prior purchases
- Product importance
- Gender
- Discount offered
- Weight
- Was the shipment late?

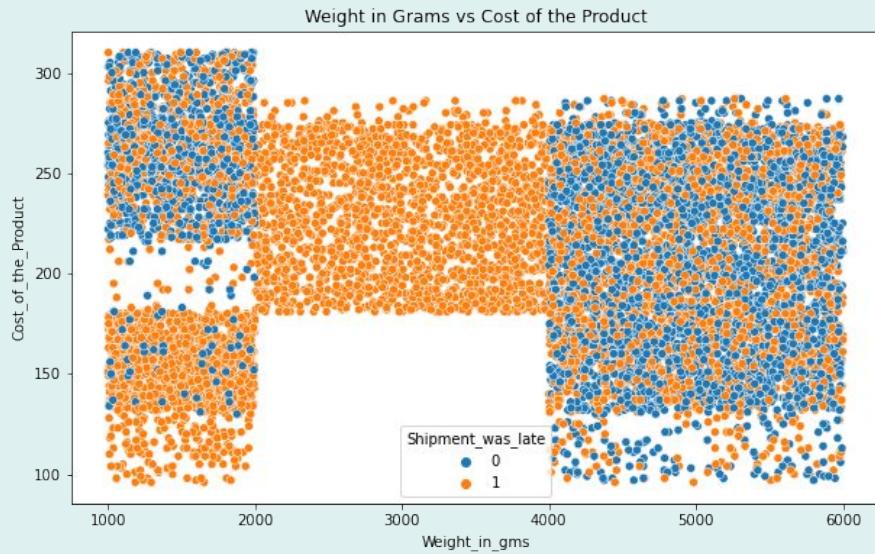


Source: [E-Commerce Shipping Data \(kaggle.com\)](#)

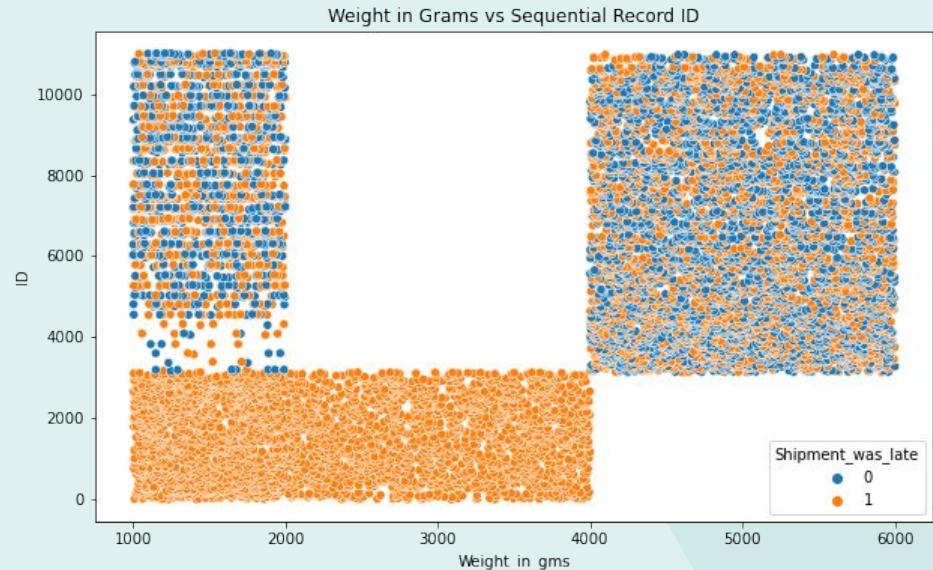
Problems with the Data: Shipment Weight



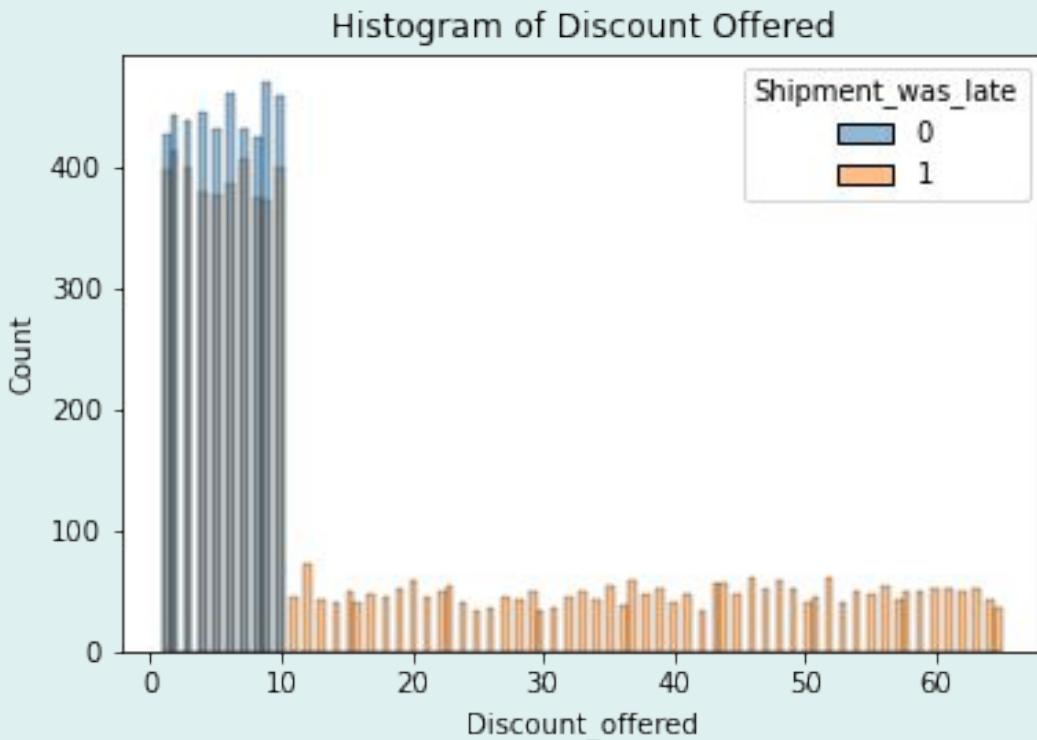
Problems with the Data: Shipment Weight



- Strange segmentation in scatterplots
- Further investigation is required



Problems with the Data: Discount Offered

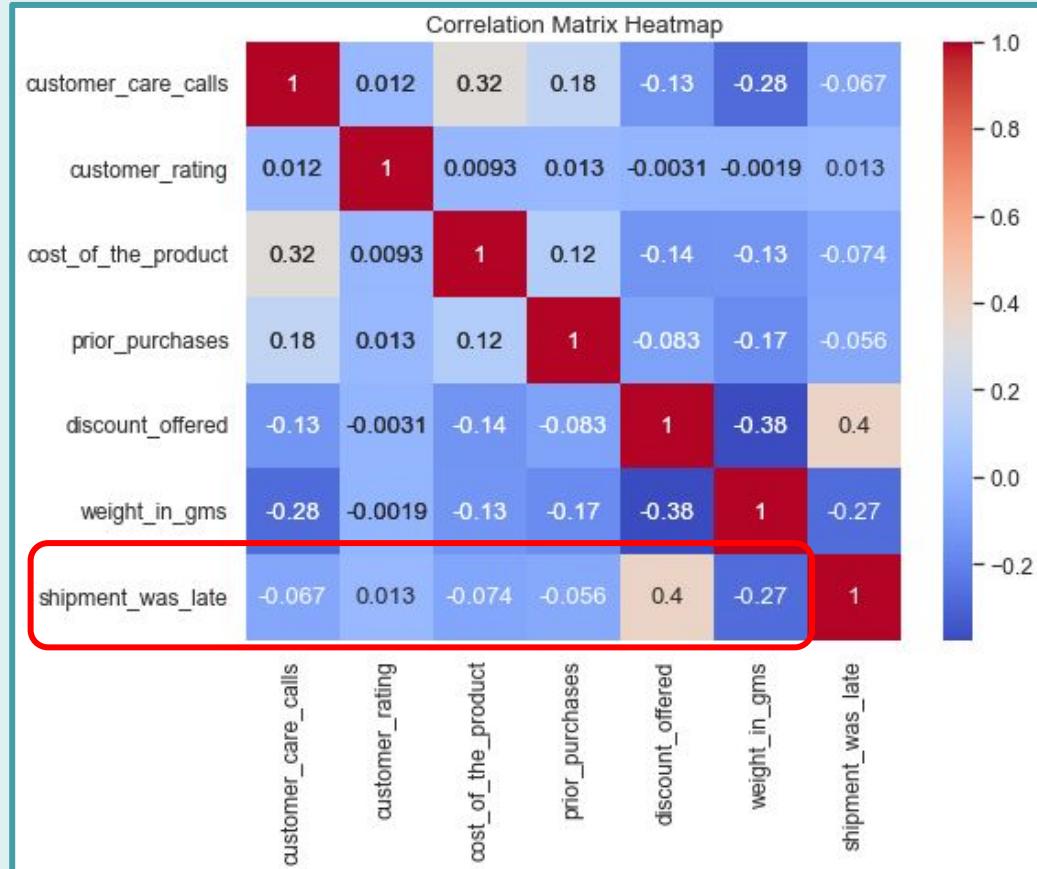


Leading Theory:
A discount of more than \$10 is
only offered if a shipment is late.

If true, we cannot use
Discount offered as a predictor
of whether a shipment will be
late!

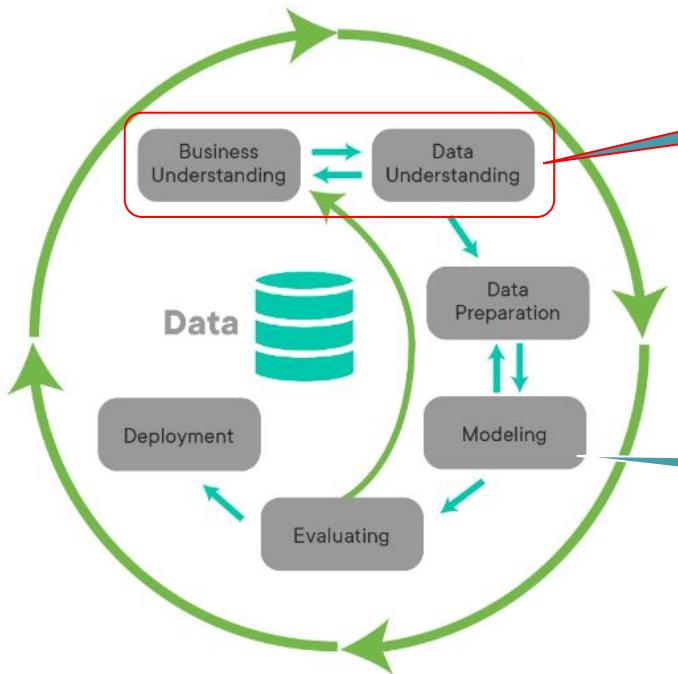
further investigation is required.

Problems with the Data: Little Correlation



Where We Are

CRoss-Industry Standard Process for Data Mining (CRISP-DM)



Due to unanswered questions about the data,
we are still here

However, we can offer
preliminary stop-gap
predictive models

03

Predictive Modeling



Business Goal: Predict if a shipment will be late

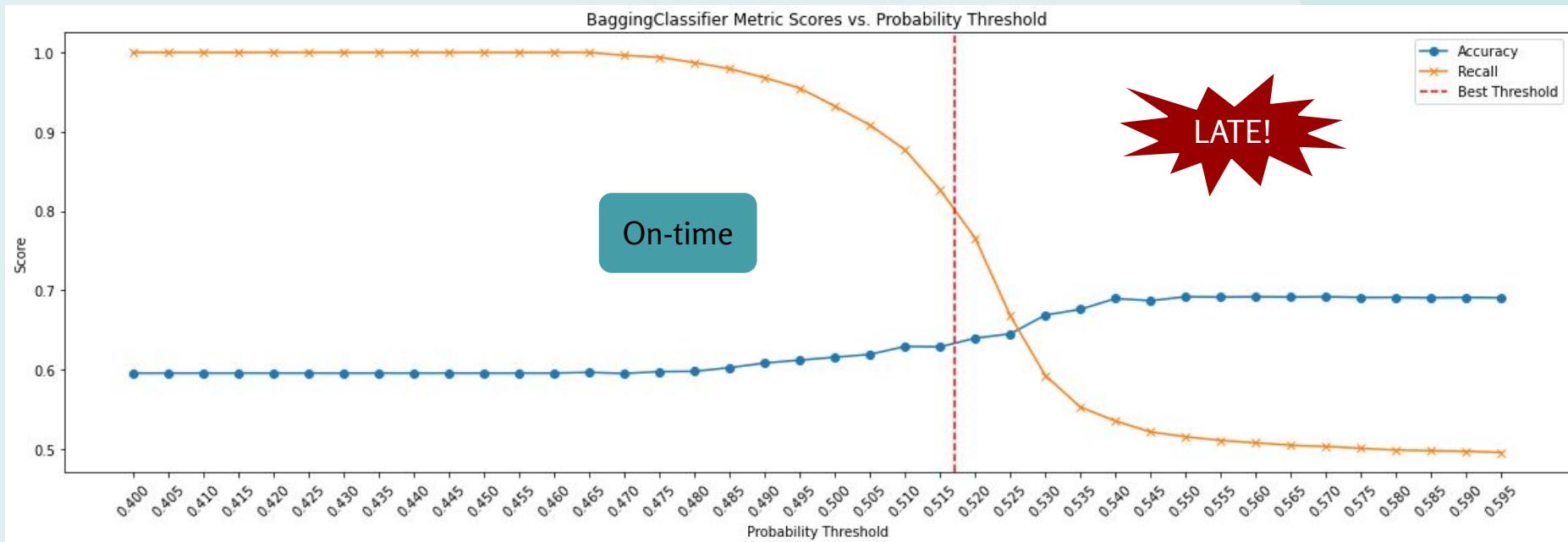
Possible prediction outcomes:

- We correctly predict a shipment will be late (True Positive)
- We correctly predict a shipment will be on-time (True Negative)
- We incorrectly predict a shipment will be late (False Positive)
- We incorrectly predict a shipment will be on-time (False Negative)



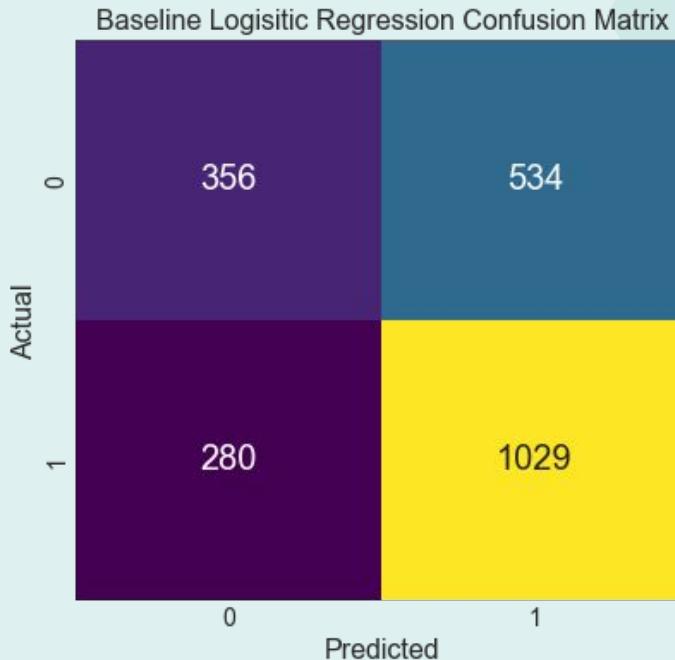
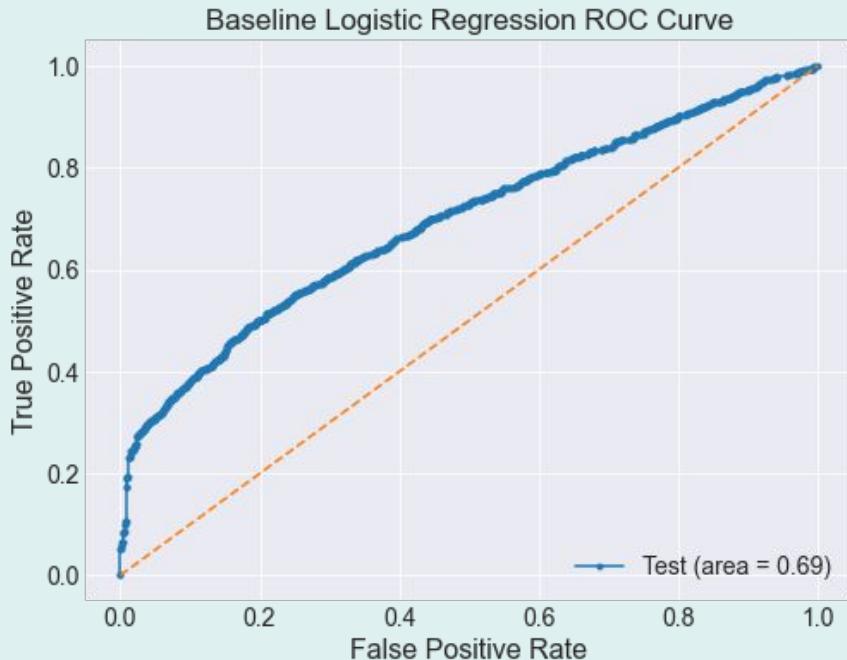
Model Tuning Methodology

- Feature Selection, outlier removal
- Key hyperparameter grid search with 5-fold cross-validation
- Probability threshold tuning of the final model



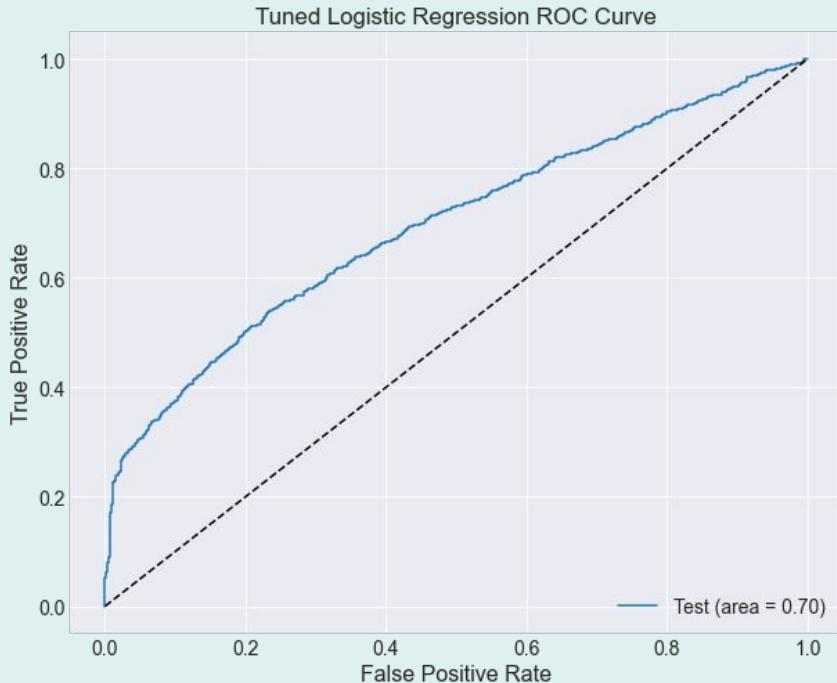
Logistic Regression Baseline Model

Precision	F1	Accuracy	Recall
0.63	0.72	0.63	0.79



Logistic Regression Hyperparameter Tuned

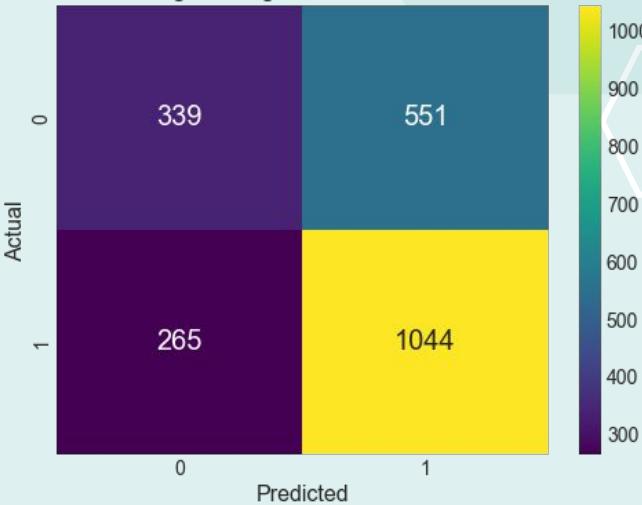
Precision	F1	Accuracy	Recall
0.65	0.72	0.63	0.80



Best Hyperparameters:

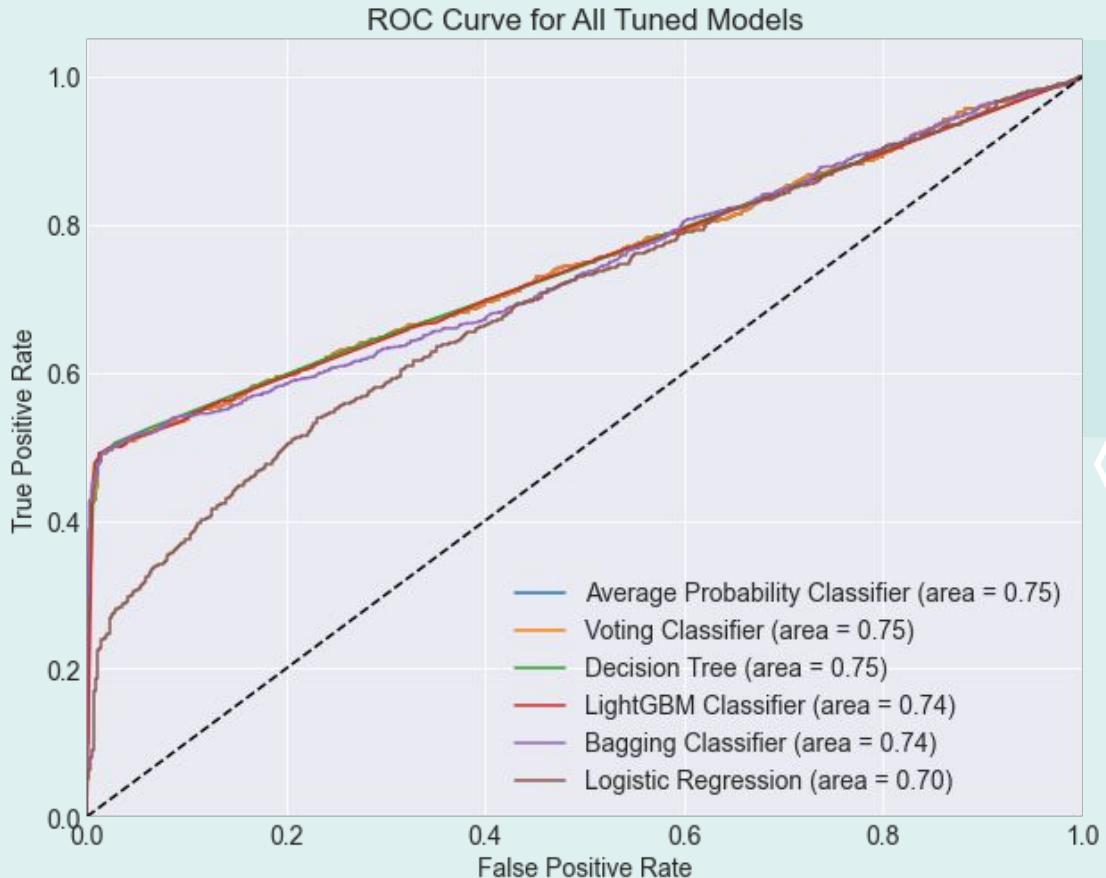
- GridSearch: (CV: 5, Scoring: Recall)
- C: 0.01
- Class_weight: None
- Max_iter: 100
- Penalty: l2
- Solver: lbfgs
- Tol: 0.0001

Tuned Logistic Regression Confusion Matrix

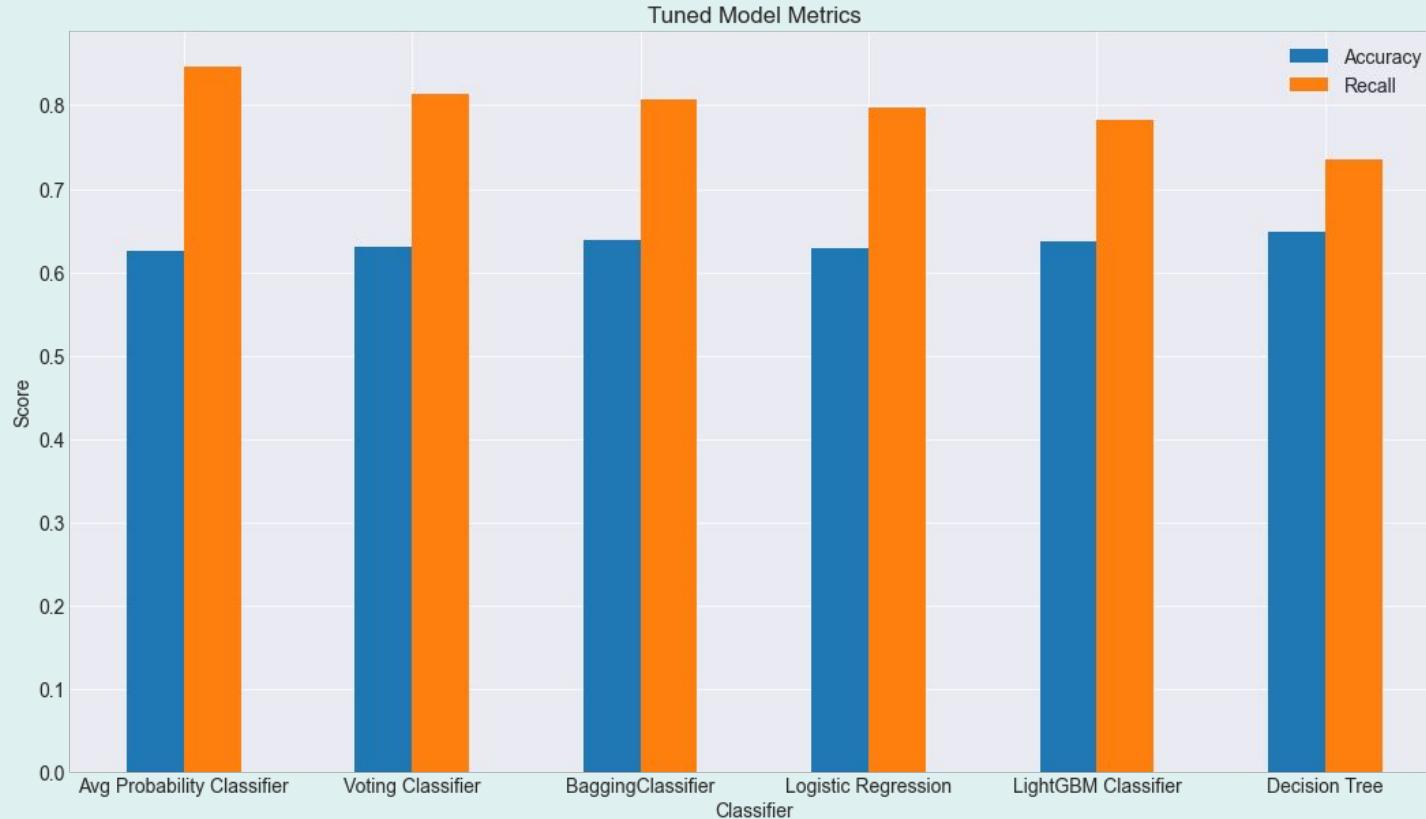


Performance of All Models

Classifier Models
Average Probability Classifier
Voting Classifier
Bagging Classifier
Logistic Regression
LightGBM Classifier
Decision Tree



All Tuned Models Final Scoring



Model Selected: Average Probability Classifier

04

Conclusion

Best Model: Average Probability Classifier

- Highest Primary Metric: Recall
- Accuracy was not the highest, but comparable to other models
- Combines predictions from multiple models

Final Metrics:

Precision	F1	Accuracy	Recall
0.64	0.73	0.63	0.85



05

Recommendation

1. Back to square 1: Business Understanding <-> Data Understanding
2. Improve data acquisition methods to increase performance of future models
3. Implement the *Average Probability Classification* model as a stop-gap to avoid late shipments until items 1 and 2 can be addressed



Final Metrics:

Precision	F1	Accuracy	Recall
0.64	0.73	0.63	0.85

06

Next Steps



1. Prioritize focus on Business/Data Understanding; answer:
 - Are discounts offered over \$10 due to prior knowledge lateness?
 - Root cause(s) for segmentation in shipment weight data
 - Root cause(s) for segmentation in ID... is the data time sequential?
2. Investigate improving data acquisition:
 - What data can we gather that will help us better predict lateness?
3. Deployment of *Average Probability Classification*, predict late shipments:
 - Flag potential late shipments for expediting delivery
 - If lateness cannot be corrected, preemptively engage with customer to inform, offer discount, etc.



Thanks!

Do you have any questions?

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How We Evaluate Our Models



Priority: Recall Score: How well we can detect if **LATE**, even if we might be wrong sometimes

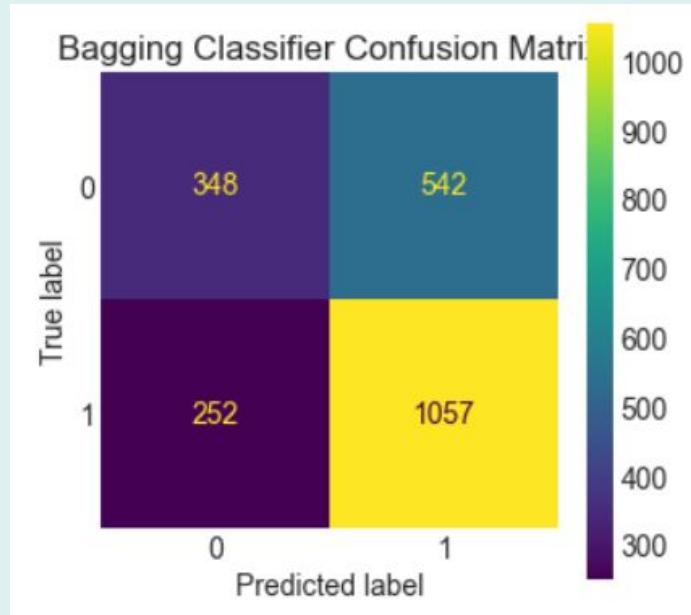
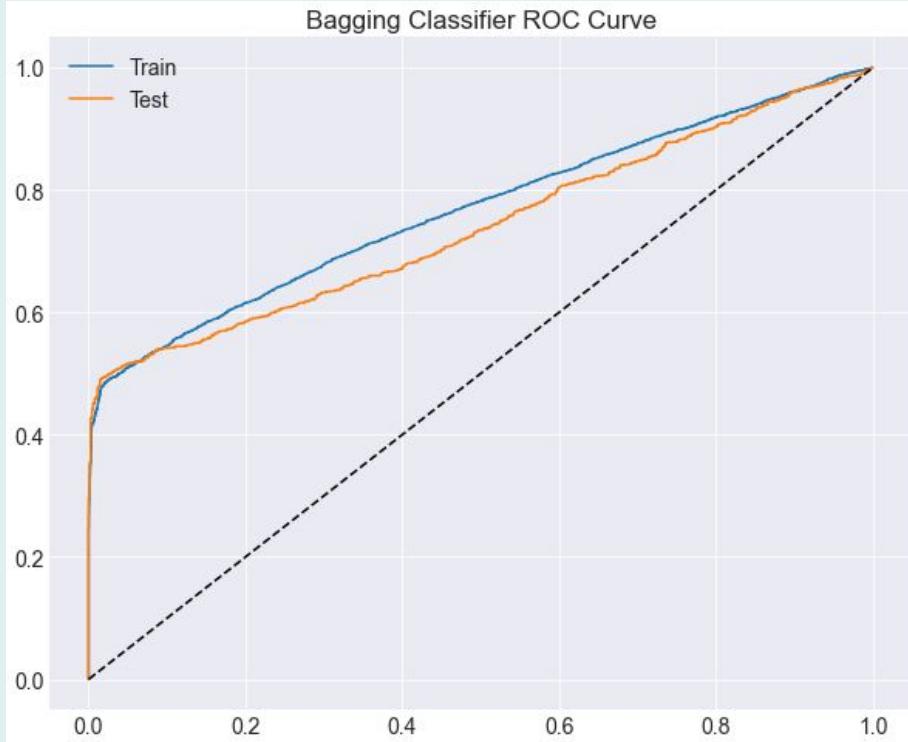
- Prioritizes customer retention by avoiding **LATENESS**



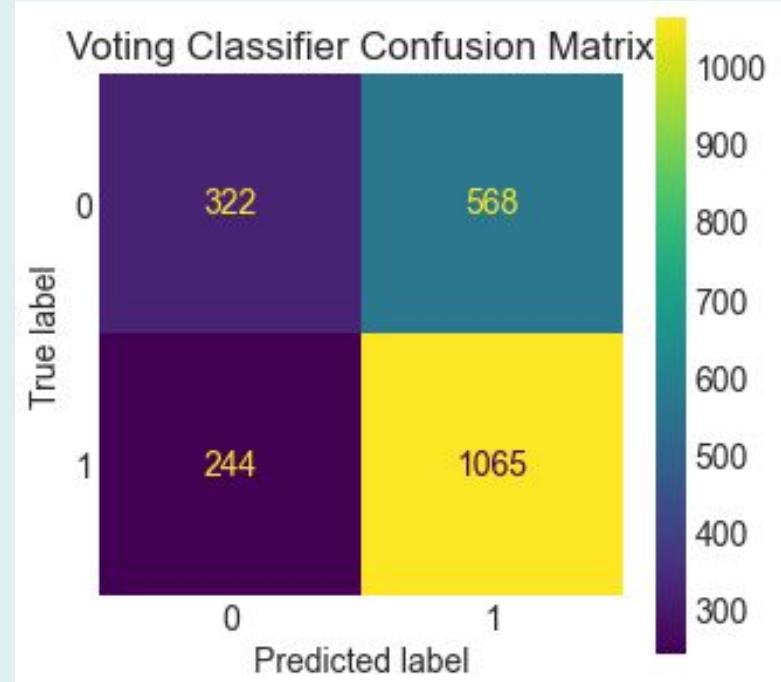
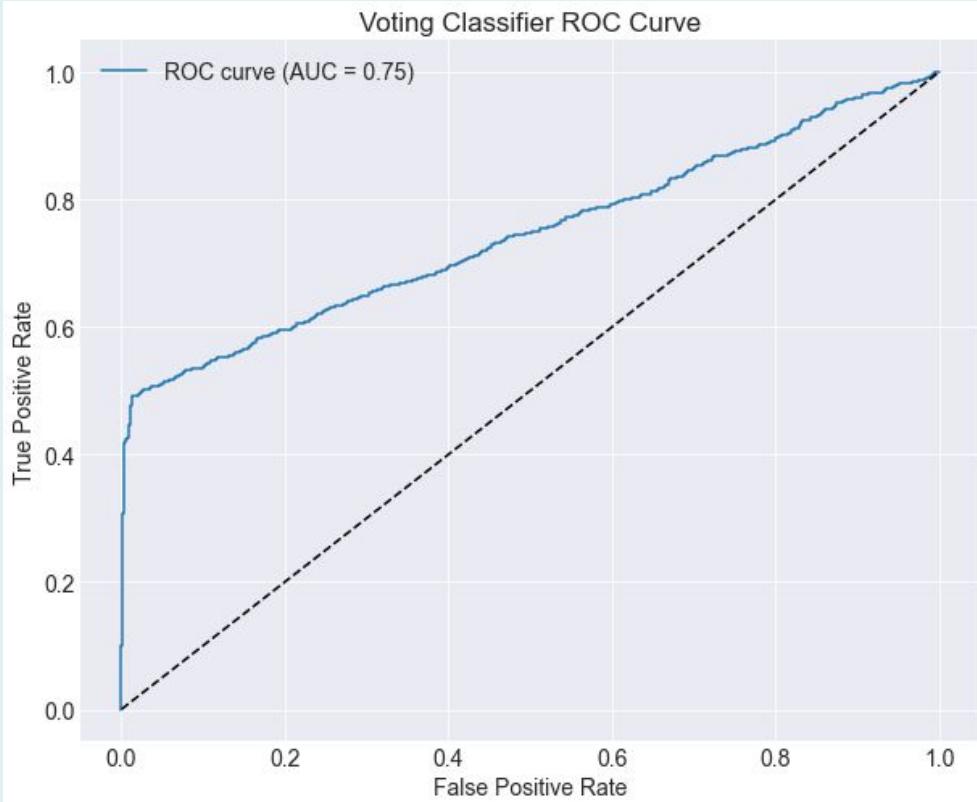
Secondary: Accuracy Score: How correctly we can detect if **LATE** or **ON-TIME**

- Evaluates the overall correctness of the model
- Avoid wasting resources on False Positives

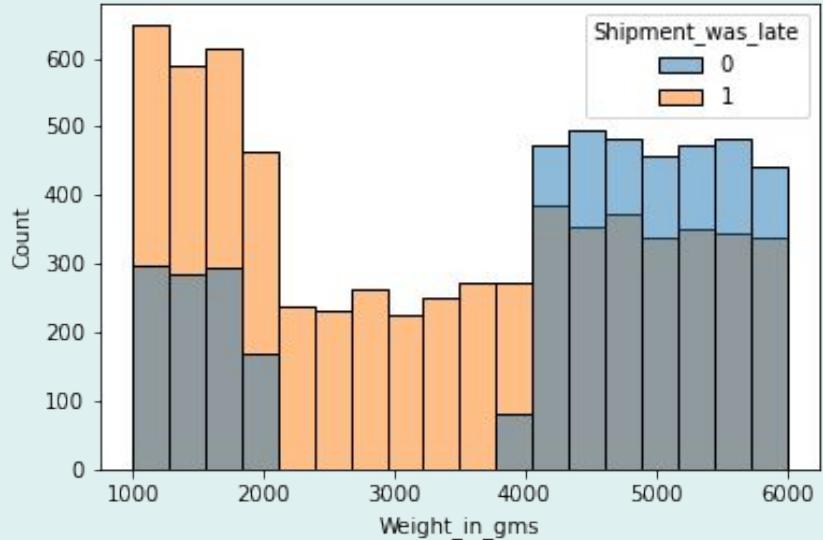
Bagging Classifier Diagnostics



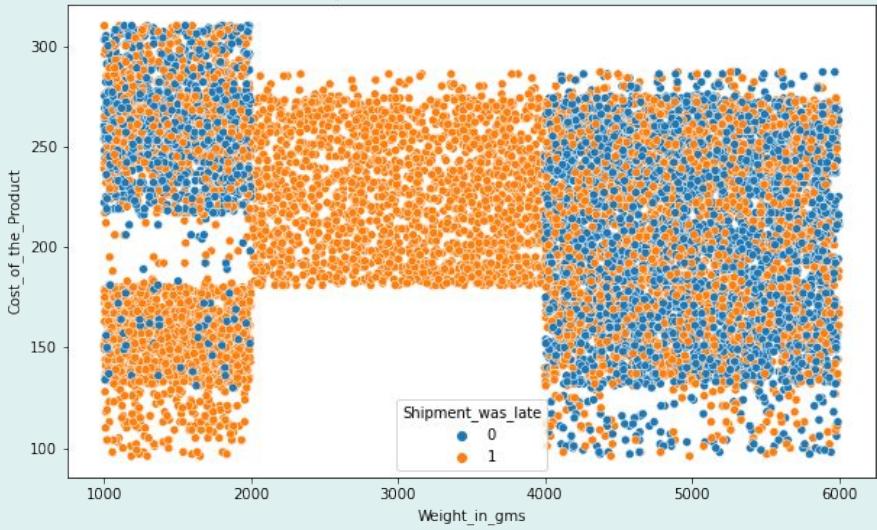
Majority Vote Classifier



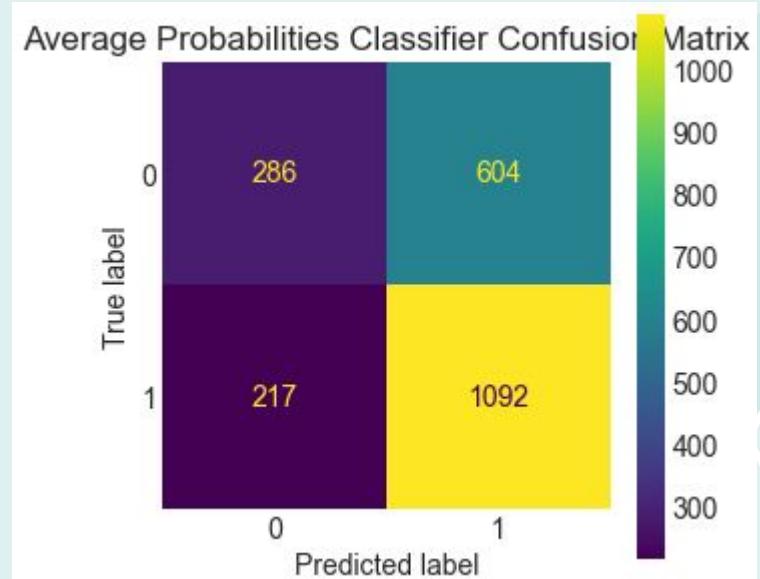
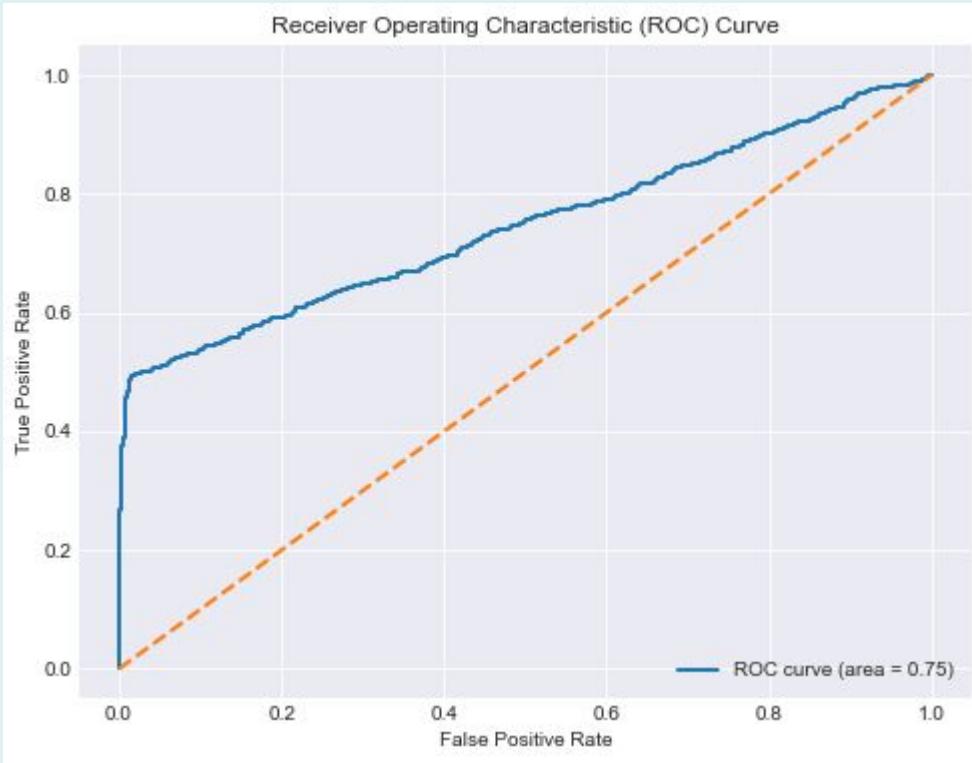
Histogram of Weight in Grams



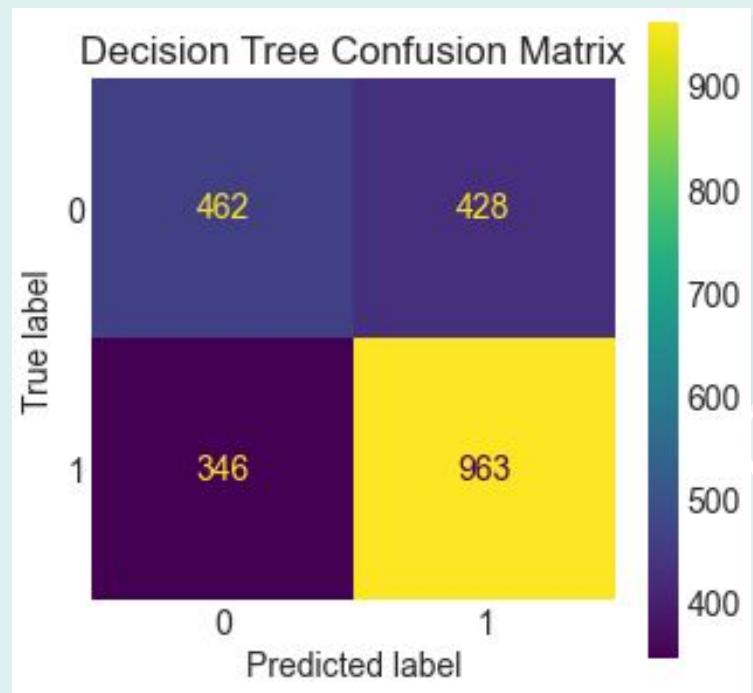
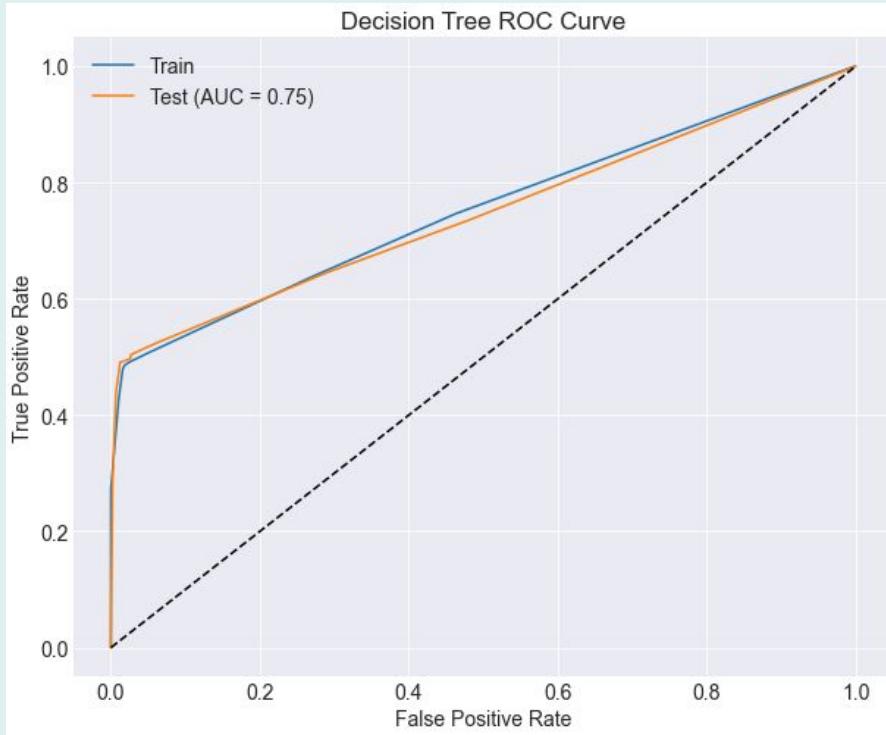
Weight in Grams vs Cost of the Product



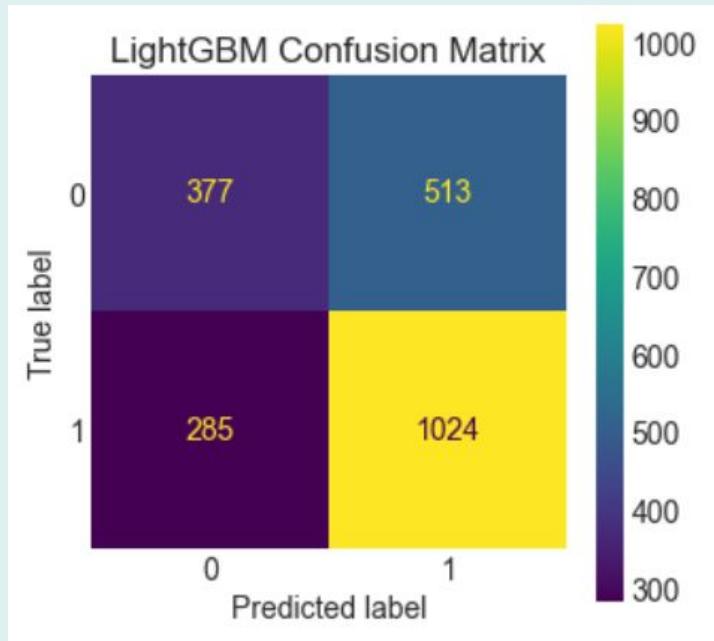
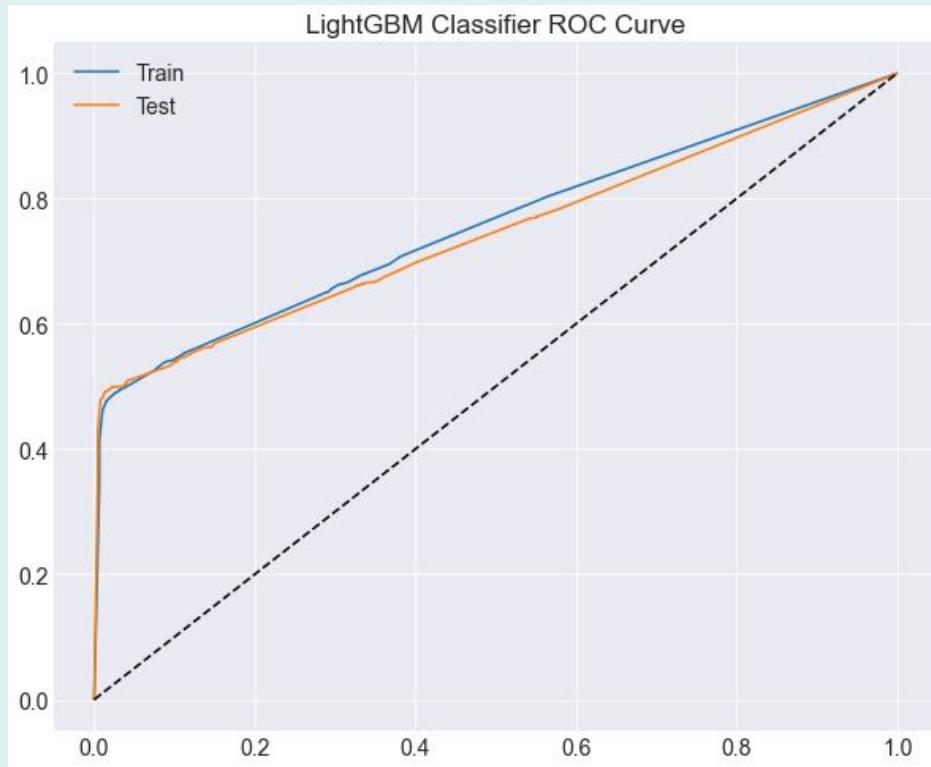
Average Probability Classifier

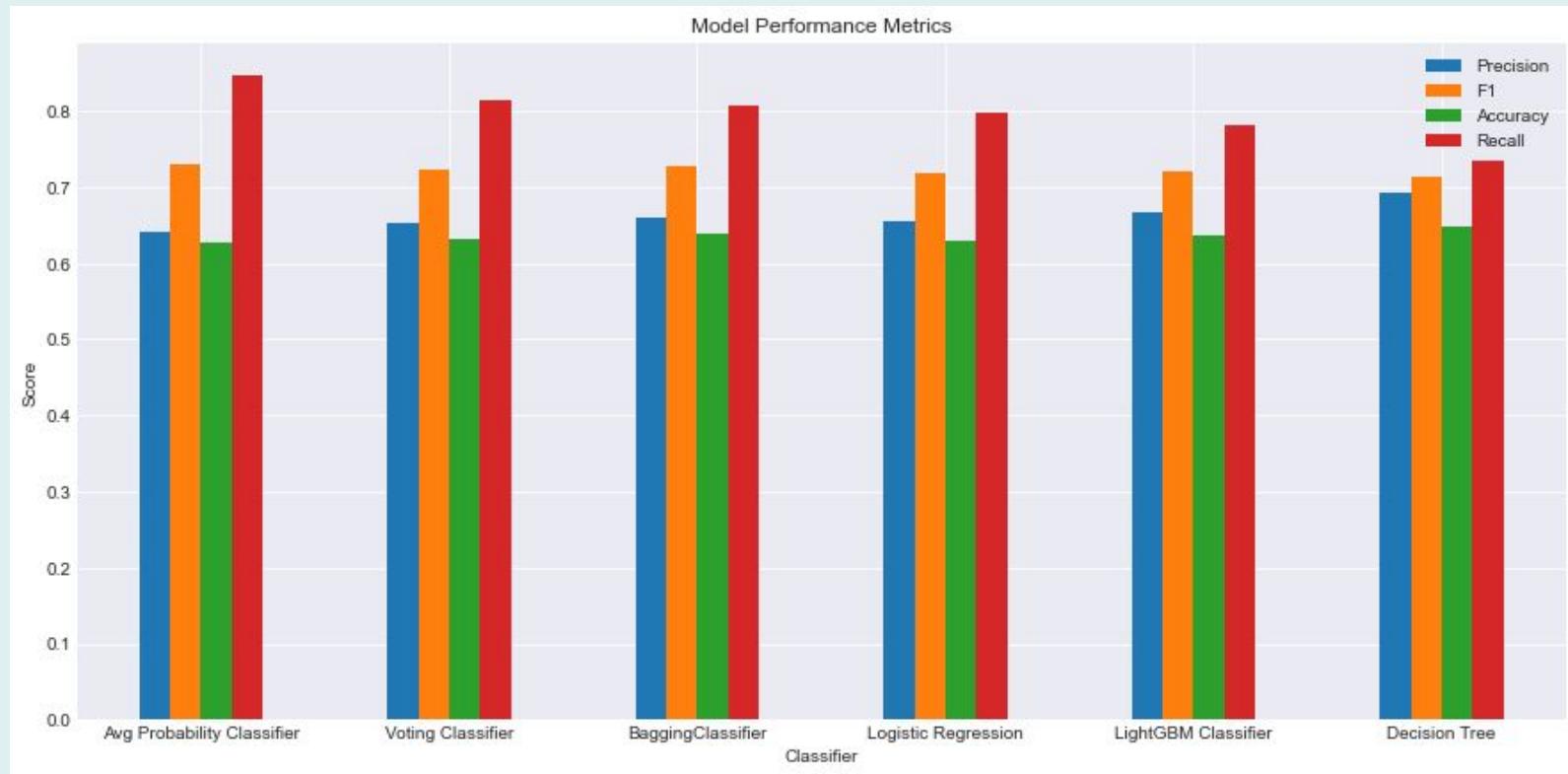


Decision Tree Diagnostics



LightGBM Classifier Diagnostics





Models Created, Tuned, Evaluated

Models:

Classifier	Precision	F1	Accuracy	Recall
Average Probability Classifier	0.64	0.73	0.63	0.85
Voting Classifier	0.65	0.72	0.63	0.81
Bagging Classifier	0.66	0.73	0.64	0.81
Logistic Regression	0.65	0.72	0.63	0.80
LightGBM Classifier	0.67	0.72	0.64	0.78
Decision Tree	0.69	0.71	0.65	0.74



Thanks!

Do you have any questions?

Brian Woo

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Dale DeFord



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Products or services



Descriptions

Provide a detailed description of your products or services, highlighting their features and benefits. Use images or videos to help illustrate your offerings



Pricing strategy

Discuss your pricing strategy, including any discounts or promotions you offer. Explain how you arrived at your pricing model and why it is competitive



Development

Share any plans you have for developing new products or services in the future. Explain how these offerings will address a need in the market and differentiate from others



Customer support

Describe customer support services offered, including technical support, training, and warranties/guarantees. Highlight customer success stories to demonstrate effectiveness

Marketing & sales strategy

Target market

Identify your target audience, including demographics, psychographics, and buyer personas

Sales process

Describe how you plan to convert leads into customers through your sales process

Value proposition

Clearly communicate the unique value that your product or service provides to customers compared to competitors

Competitive analysis

Analyze the strengths and weaknesses of your competitors in terms of their products/services, pricing strategy...

Mk channels

Outline the channels you will use to reach your target market, such as social media, email marketing...

Metric and goals

Define key performance indicators (KPIs) that measure the success of your marketing and sales efforts. Set specific goals

Budget for this quarter

\$1,000,000,000

Product development

\$1,500,000,000

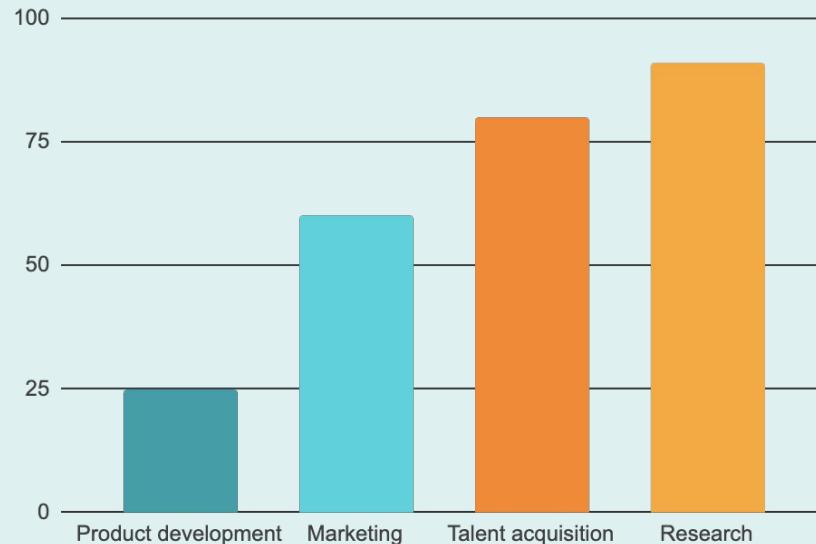
Marketing

\$998,300,000

Talent acquisition

\$1,000,000,000

Research



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Revenue information

	Q1	Q2	Q3	Q4	Total
Product sales	\$50,000	\$60,000	\$75,000	\$90,000	\$275,000
Labor	\$20,000	\$24,000	\$30,000	\$36,000	\$110,000
Salaries	\$15,000	\$18,000	\$20,000	\$24,000	\$77,000
Marketing	\$7,000	\$8,000	\$9,000	\$10,000	\$34,000
Net income	\$24,500	\$26,750	\$28,000	\$34,250	\$113,500
Rent	\$5,000	\$5,000	\$5,000	\$5,000	\$20,000
Utilities	\$1,500	\$1,750	\$2,000	\$2,250	\$7,500



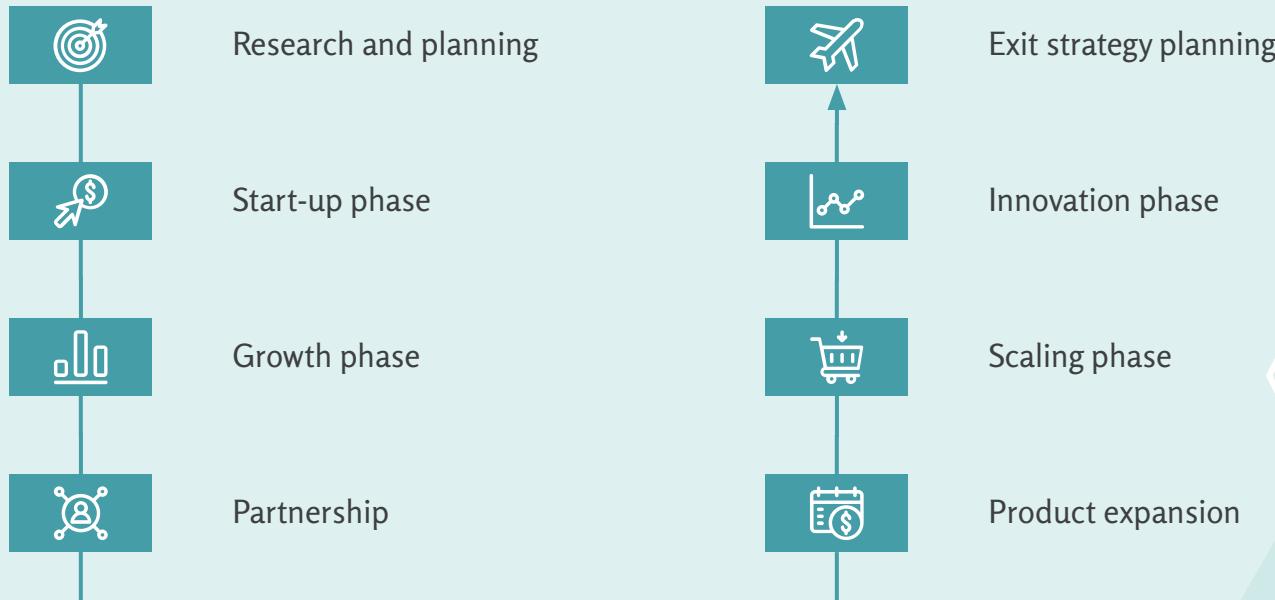
Mockup

A mockup provides a visual representation of your product or service, allowing investors or stakeholders to better understand what you're offering and how it works

A teal smartphone mockup is shown from a slightly elevated angle. The screen displays a white background with a dark teal header bar at the top. In the header bar, there is a small teal icon of a clipboard with a document and a pen. Below the header, the text "History and vision" is displayed in a bold, black, sans-serif font. Underneath this heading, there is a paragraph of text in a smaller, regular black font: "Provide a brief history of your company, including when it was founded and its evolution over time. Then, describe your company's vision for the future and its long-term objectives". At the bottom of the phone's body, there is a small, horizontal white rectangular button.



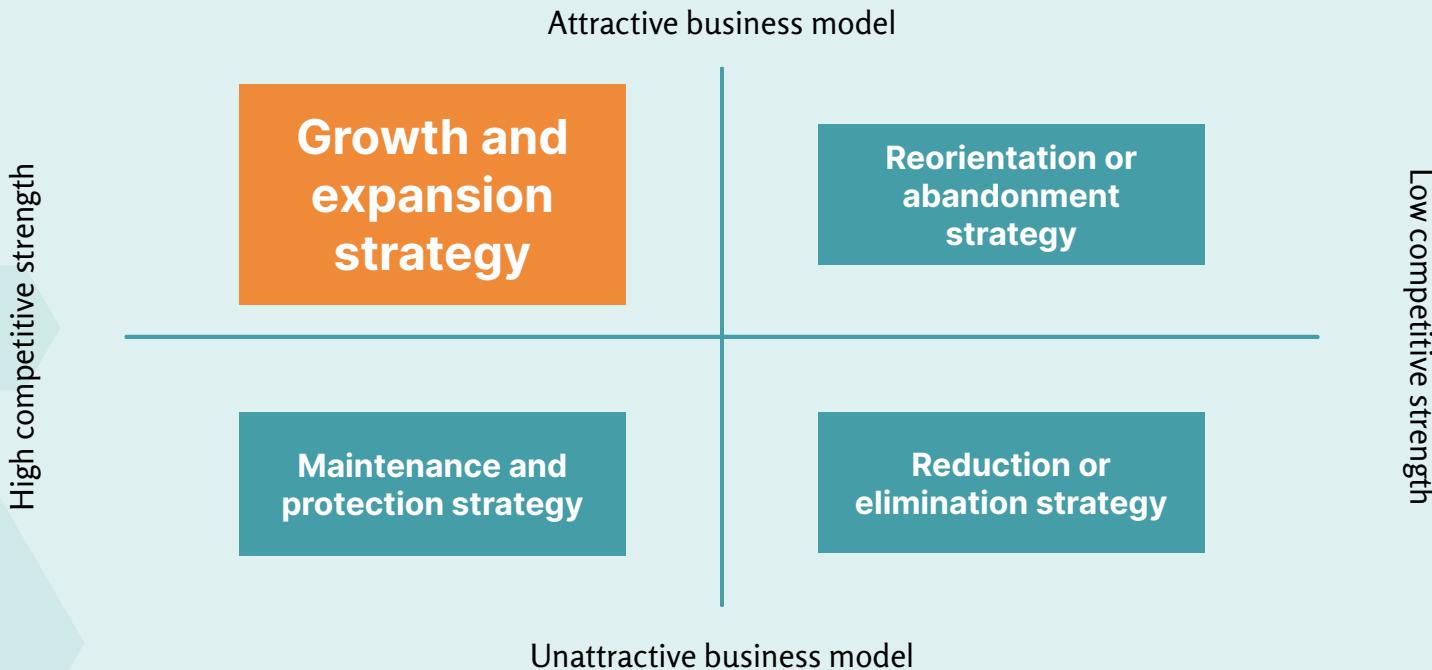
Business plan timeline



Canvas infographic

Key partners	Key activities	Value propositions	Customer relationships	Customer segments
Identify important partners for your business	Identify key activities that create value for customers Key resources Identify important resources needed for your business	Define what sets your business apart from competitors	Determine how you will interact with customers Channels Determine how you will reach and engage with customers	Define specific target customer groups
Cost structure		Revenue streams		
Identify fixed and variable costs associated with the business		Define sources of revenue for your business		

My business strategy



Target infographic

Demographic

Age	25-50 years old
Gender	Male and female
Occupation	Employees and students
Family situation	Single and married people
Income	\$50,000/year

Behavior

- They may be interested in personal and professional development, as they are both employees and students
- They may be tech-savvy and use technology to streamline their work and personal life

Passive buyers  25%

Active buyer  75%

Locations



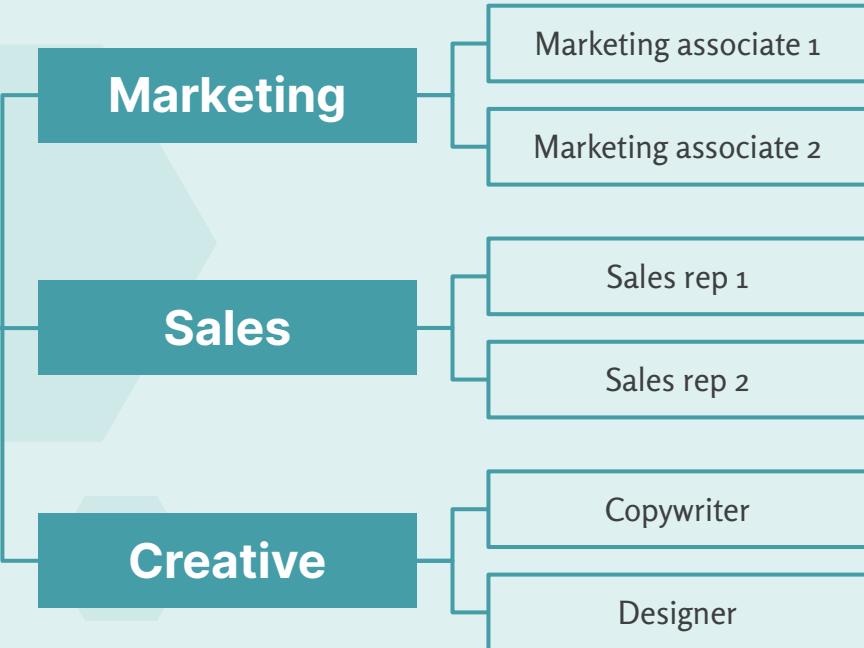
Region Europe, Asia

Area Urban

Follow the link in the graph to modify its data and then paste the new one here. [For more info, click here](#)

chart

eo



Market size infographic

\$100 M



"With the innovative approach and unique features, we aim to capture a significant portion of the \$100 million"

\$20 M

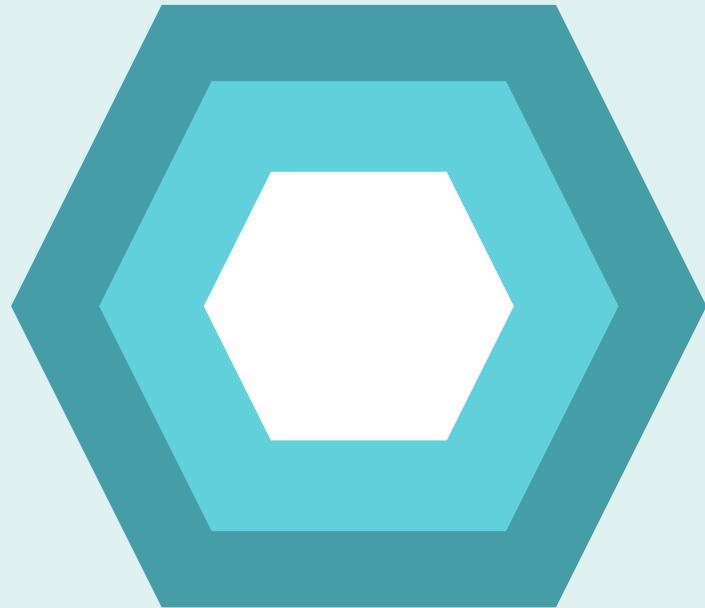


"The research indicates that the market for [product/service] is projected to reach \$20 million by next year"

\$5 M



"The market for [product/service] is currently valued at \$5 million"



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Vectors:

- [Warehouse transportation and delivery icons flat set isolated vector illustration](#)



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Photos:

- [Local retailer helping his client to pay](#)



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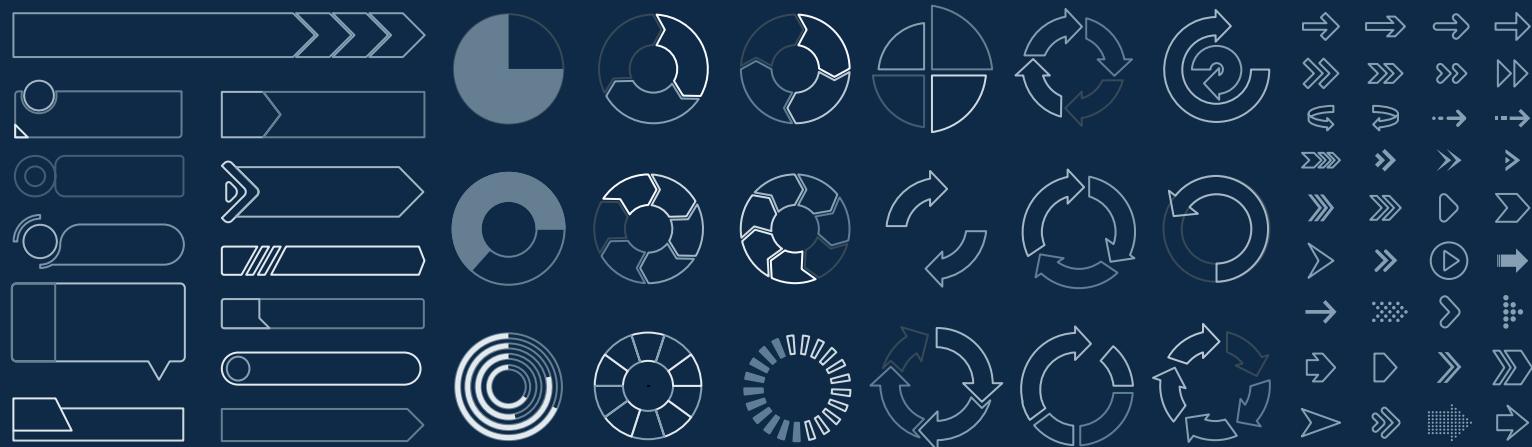
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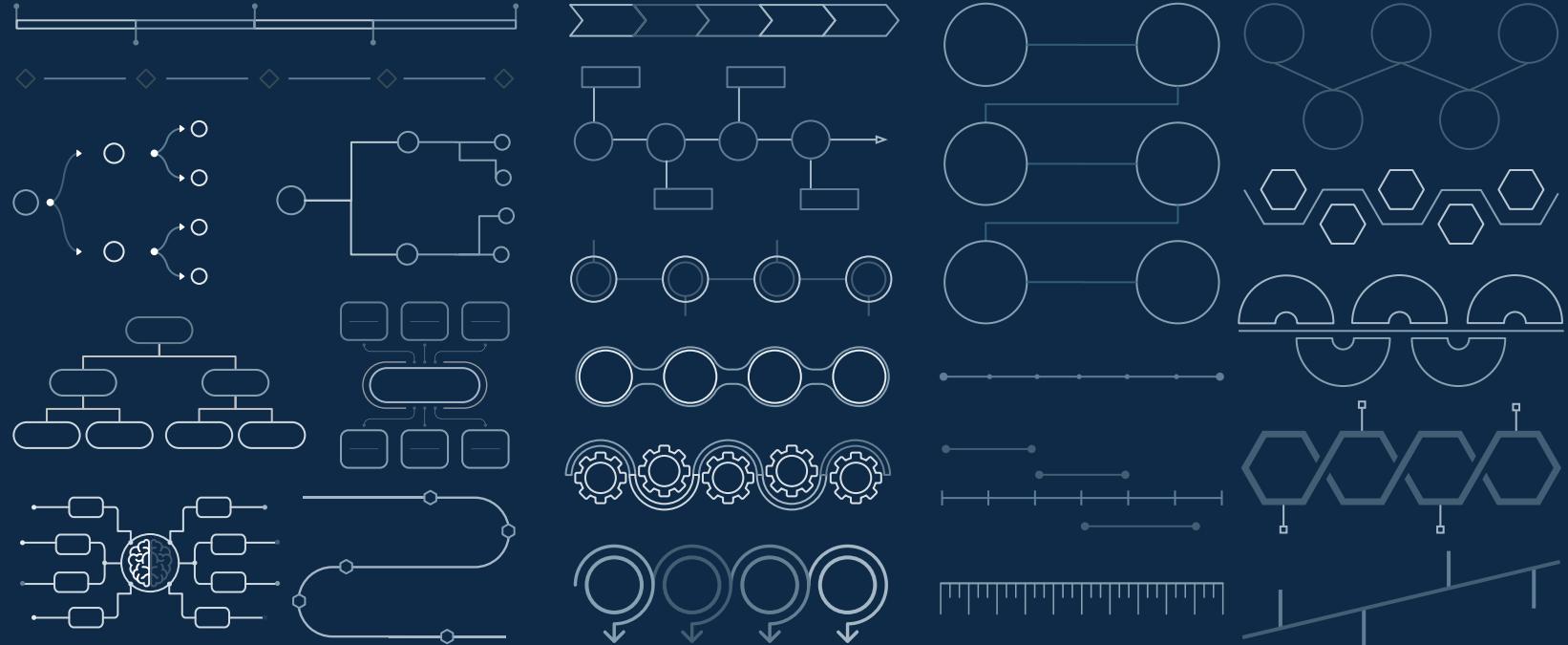
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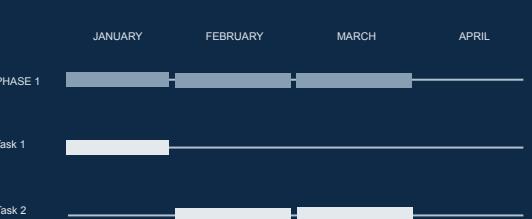
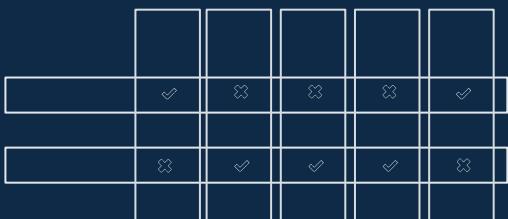
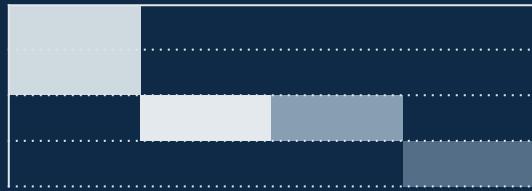
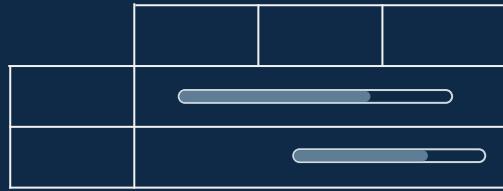
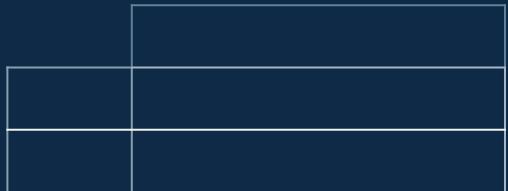
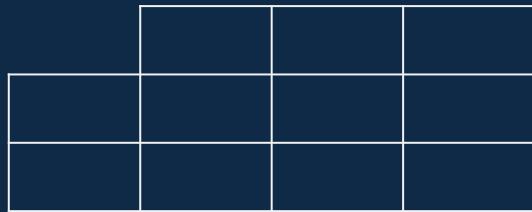
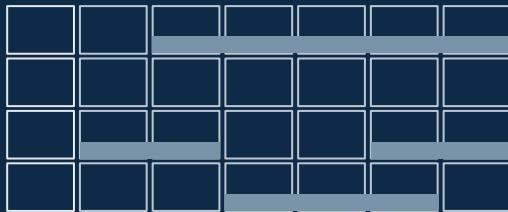
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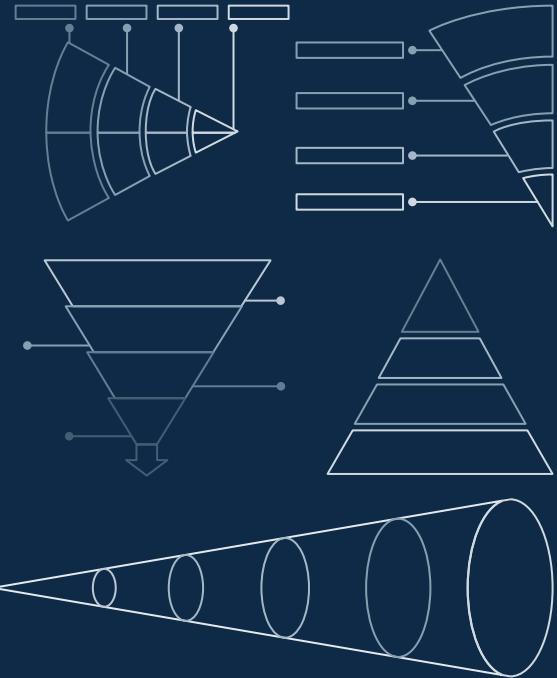
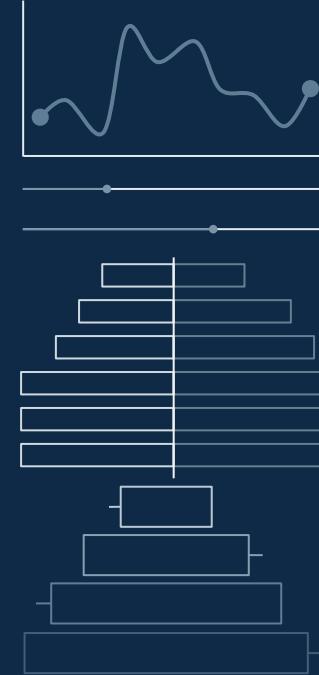
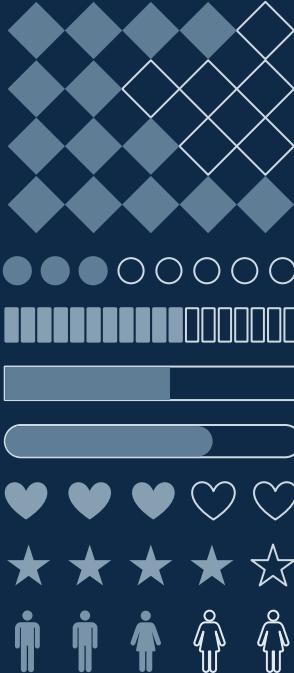
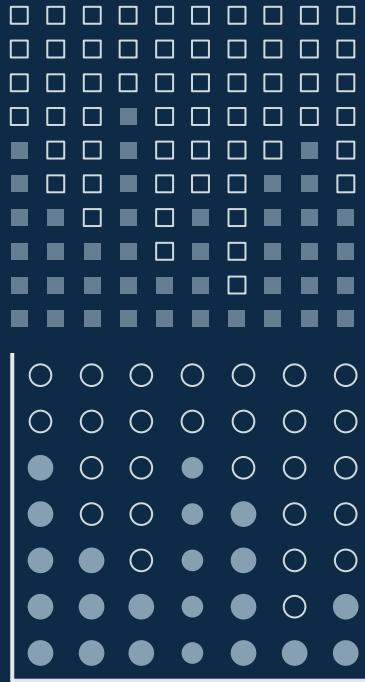












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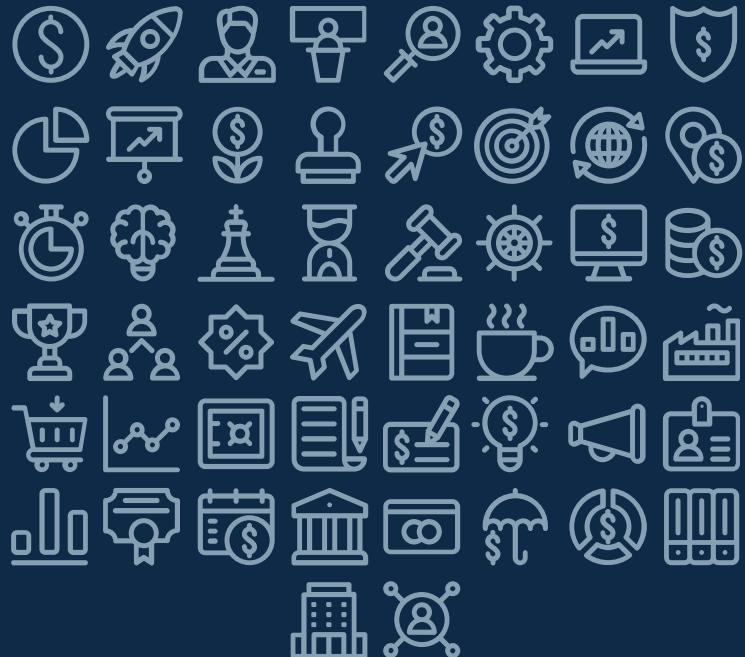
Educational Icons



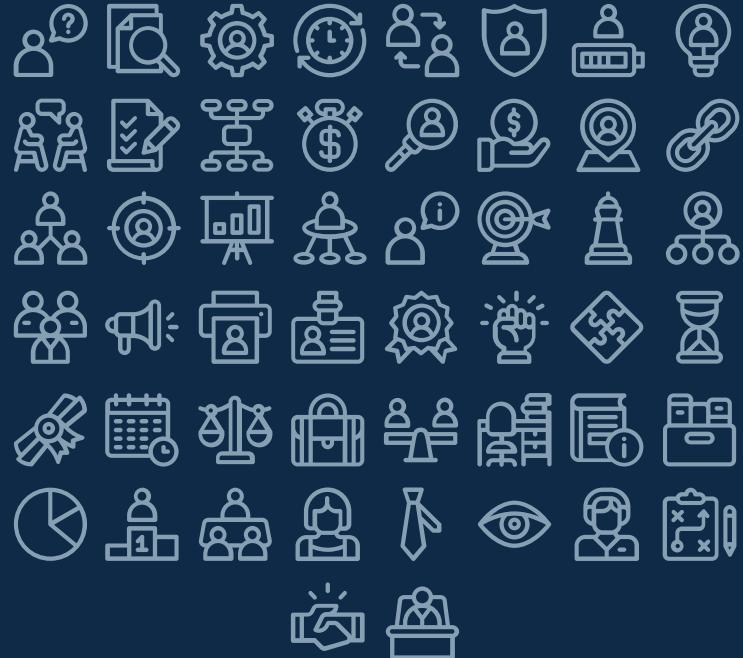
Medical Icons



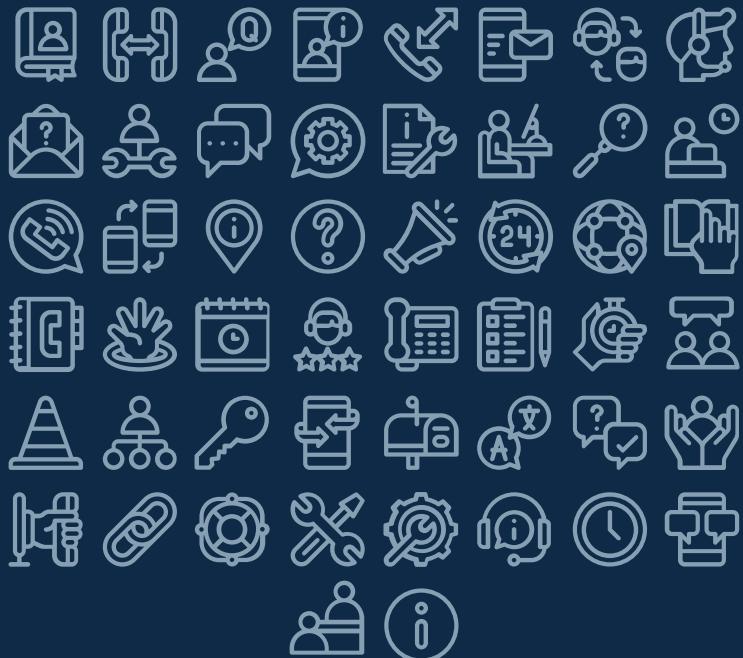
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Avatar Icons



Creative Process Icons



Performing Arts Icons



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SEO & Marketing Icons





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Executive summary

Analysis of the companies shipping data, and creation of machine learning models that predict whether or not a given shipment will be delivered to the customer on time.