

Intelligent U.S. Vehicle Market Solutions

Integrated Strategies for Personalized Recommendations and Inventory Planning

Berkeley

Master of Analytics

COLLEGE OF ENGINEERING

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Introduction

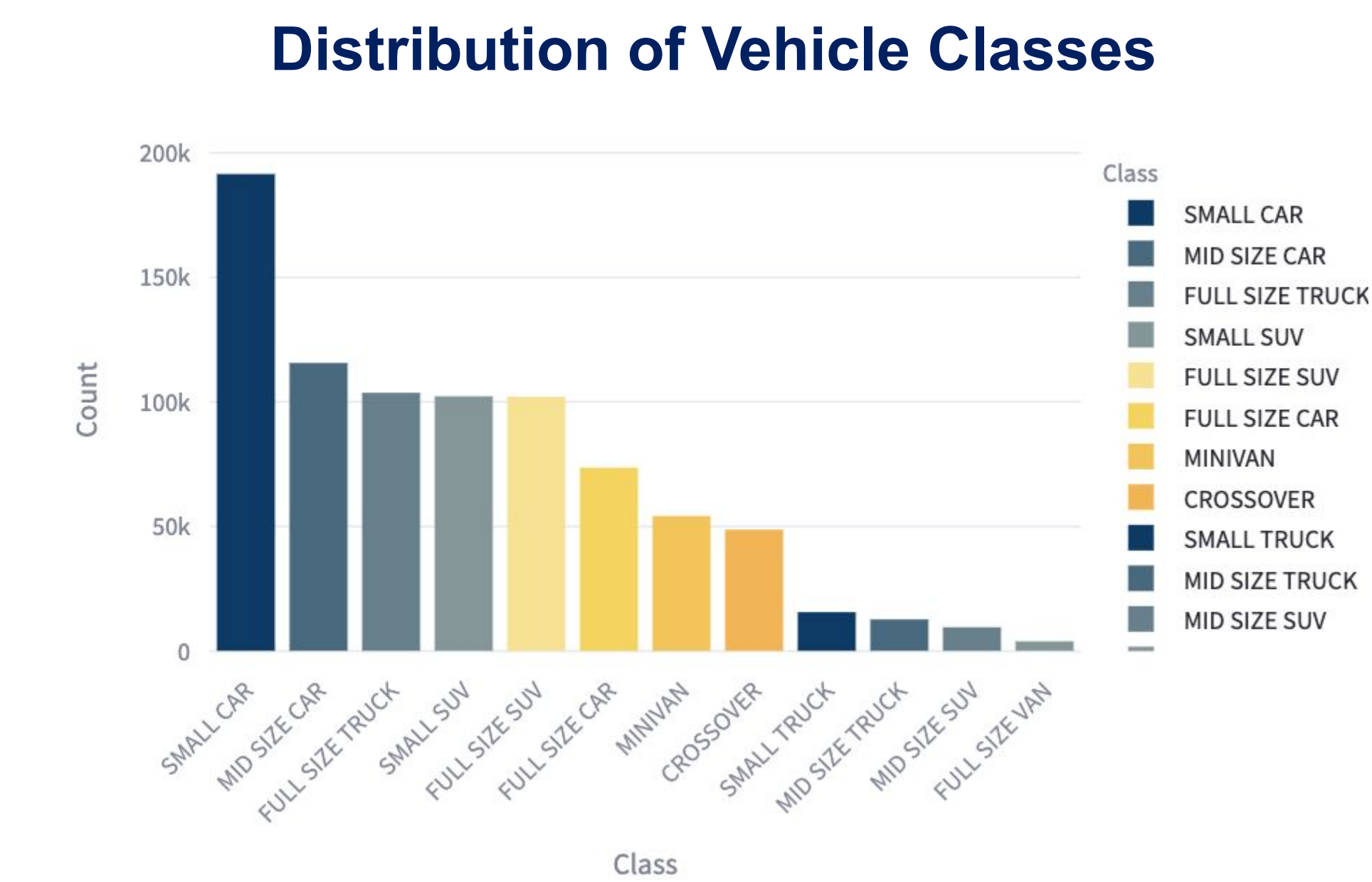
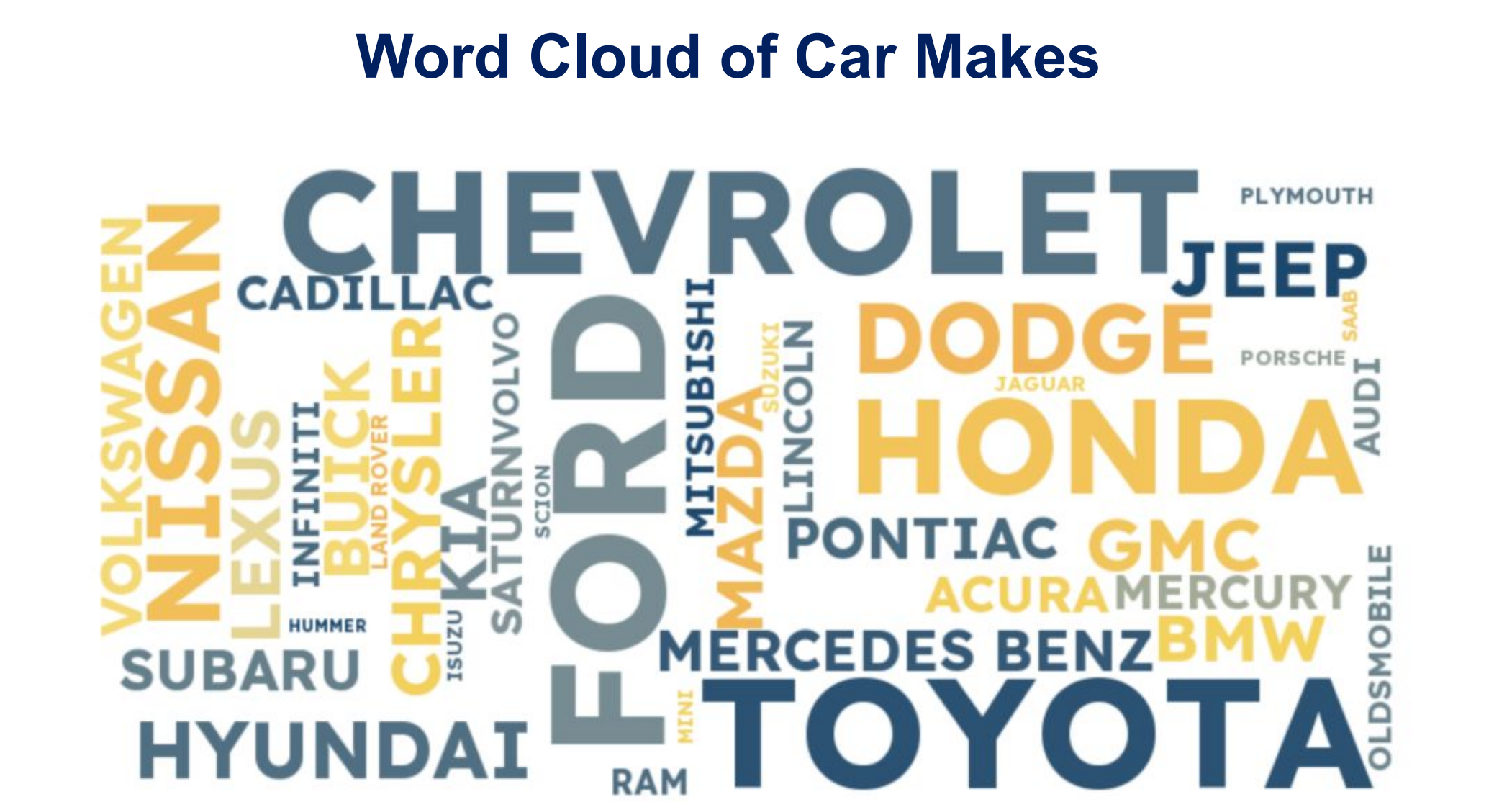
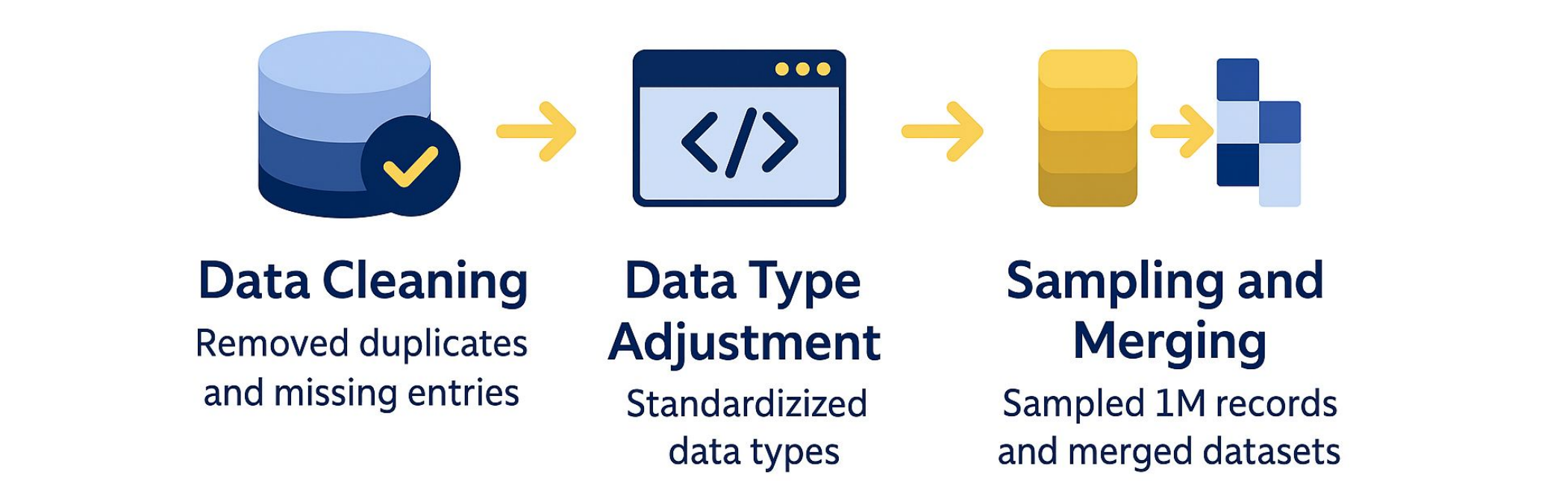
The automotive market struggles with **fragmented consumer understanding** and **limited demand visibility**, resulting in **ineffective vehicle recommendations** and **suboptimal inventory planning** for dealerships.

OBJECTIVE:
Develop an intelligent system that:

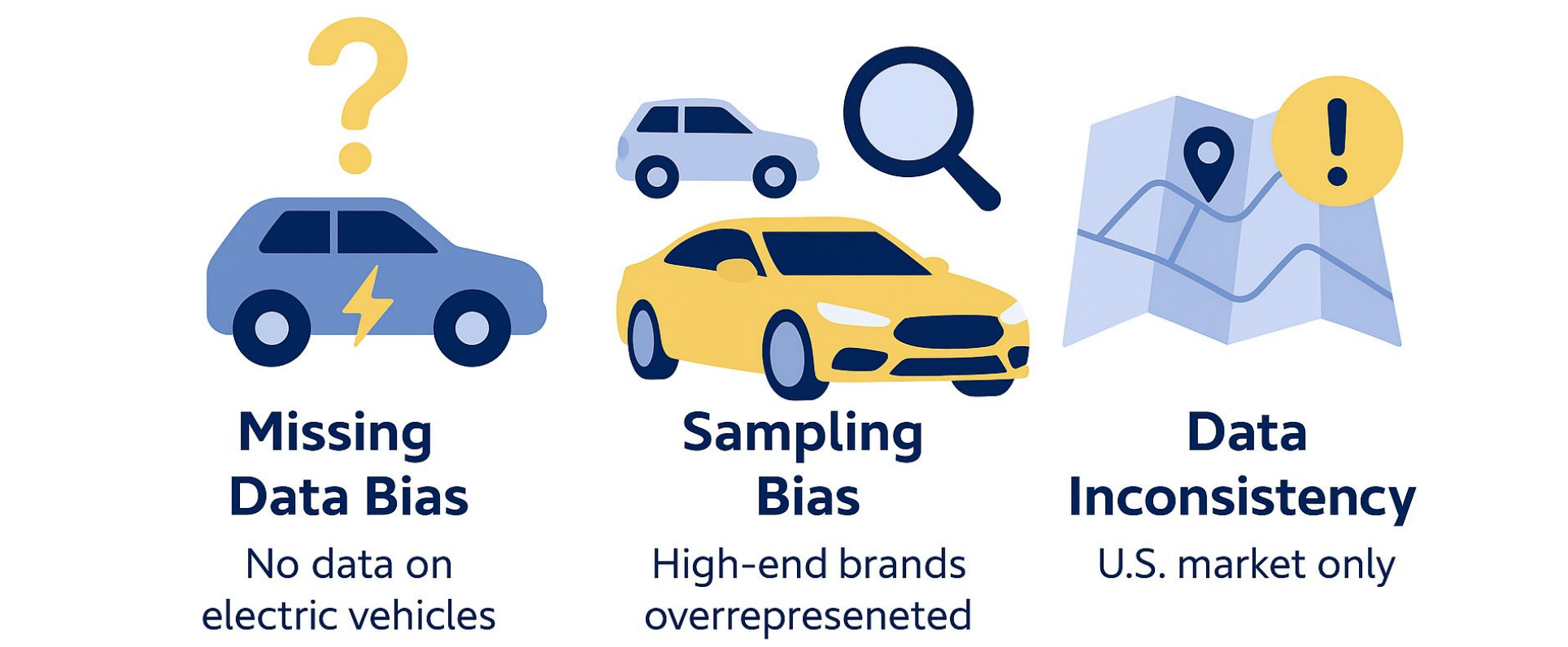


Data Analysis

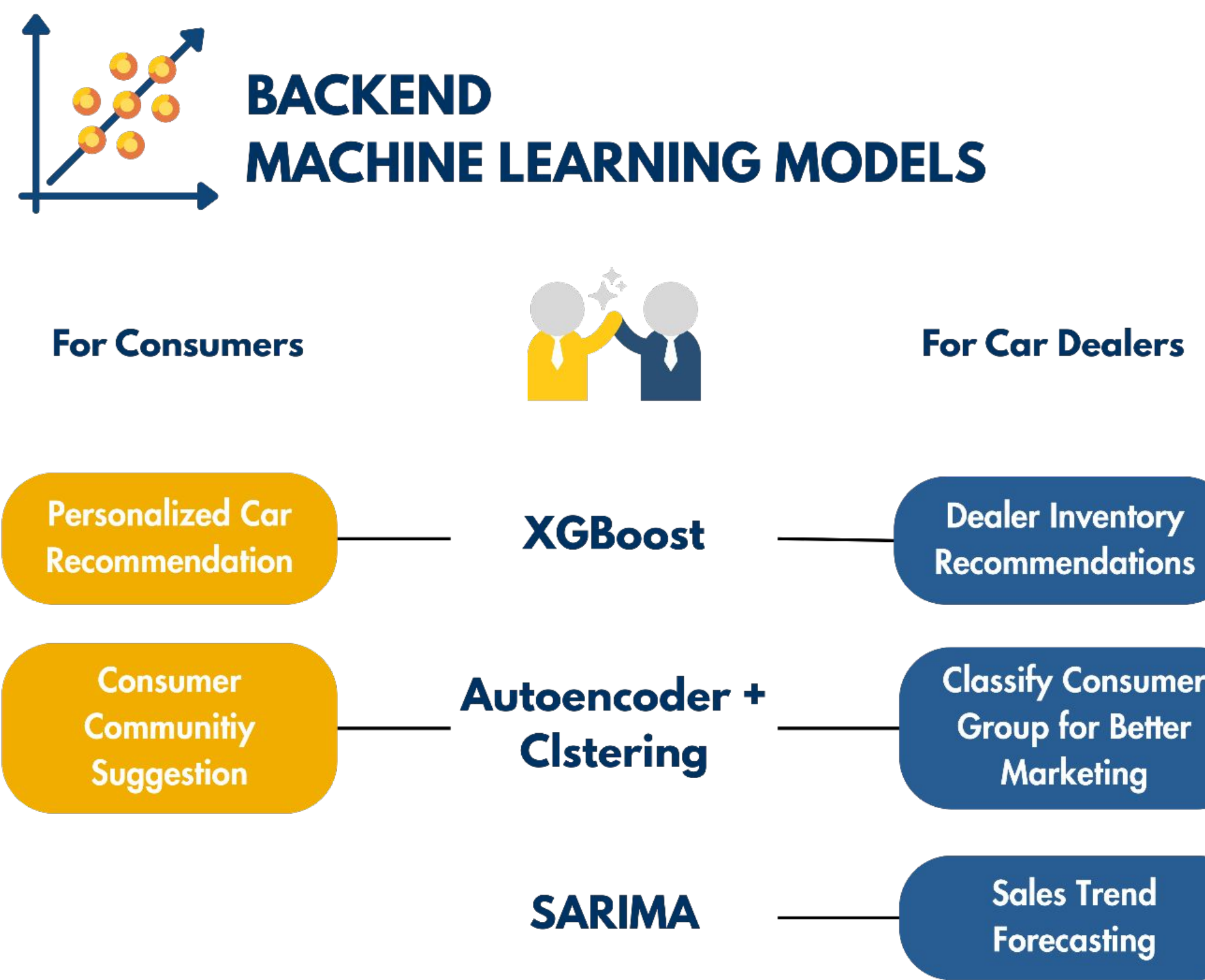
- Dewey - Auto Ownership:** Vehicle ownership details and consumer brand affinities.
- Dewey - Consumer Profiles:** Consumer segmentation info of demographic and lifestyle.
- Kaggle - Vehicle Fuel Economy:** Fuel efficiency data covering MPG, emissions, etc.



LIMITATIONS:



Methods



DETAILS

- Trained a **multi-output XGBoost** model to predict Make, Model, and Fuel Type.

- Created **Neural Collaborative Filtering (NCF)** models to predict top 5 preferred brands and styles for each zip code region.
- Used an **autoencoder** to learn a **compressed representation**, then **cluster** that latent space.
- Applied a **time-series forecasting model (tuned-SARIMA)** to predict future car purchases.

PERFORMANCE METRICS	VALIDATION															
<p>“Brand” Stocking Prediction Accuracy</p>	<table><tr><th></th><th>precision</th><th>recall</th><th>f1-score</th><th>support</th></tr><tr><td>macro avg</td><td>0.778</td><td>0.797</td><td>0.782</td><td>2389</td></tr><tr><td>weighted avg</td><td>0.853</td><td>0.844</td><td>0.848</td><td>2389</td></tr></table>		precision	recall	f1-score	support	macro avg	0.778	0.797	0.782	2389	weighted avg	0.853	0.844	0.848	2389
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macro avg	0.778	0.797	0.782	2389												
weighted avg	0.853	0.844	0.848	2389												
<p>“Style” Stocking Prediction Accuracy</p>	<table><tr><th></th><th>precision</th><th>recall</th><th>f1-score</th><th>support</th></tr><tr><td>macro avg</td><td>0.861</td><td>0.886</td><td>0.829</td><td>1485</td></tr><tr><td>weighted avg</td><td>0.882</td><td>0.885</td><td>0.881</td><td>1485</td></tr></table>		precision	recall	f1-score	support	macro avg	0.861	0.886	0.829	1485	weighted avg	0.882	0.885	0.881	1485
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weighted avg	0.882	0.885	0.881	1485												
<p>“Brand” Confusion Matrix</p>	<p>Confusion Matrix: 371 predicted correctly, 149 predicted incorrectly Approximately ~ 71% recall for class 0</p> <p>1645 predicted correctly, 224 predicted incorrectly Approximately ~ 88% recall for class 1</p>															
<p>“Style” Confusion Matrix</p>	<p>Confusion Matrix: 218 predicted correctly, 114 predicted incorrectly Approximately ~ 66% recall for class 0</p> <p>1026 predicted correctly, 47 predicted incorrectly Approximately ~ 96% recall for class 1</p>															

• FOR Neural Collaborative Filtering (NCF) for Region–Brand and Region–Vehicle Style Inventory Recommendations

• FOR Neural Collaborative Filtering (NCF) for Region-Brand and Region-Vehicle Style Inventory Recommendations

Results

FOR CAR BUYERS

- Provide a few basic details
- Get **personalized** car brand, model, and type recommendations
- Connect with a **community** of car enthusiasts to share experiences, seek advice, and discuss automotive topics

Home

Data Overview

Vehicle Matchmaker

Find Your People

Market Insights

Inventory Management

General Info

GENDER: F AGE: 30

CITY: AARONSBURG STATE: AK ZIP:

Your Current Car

MAKE: ACURA MODEL: 100 YEAR: 2020

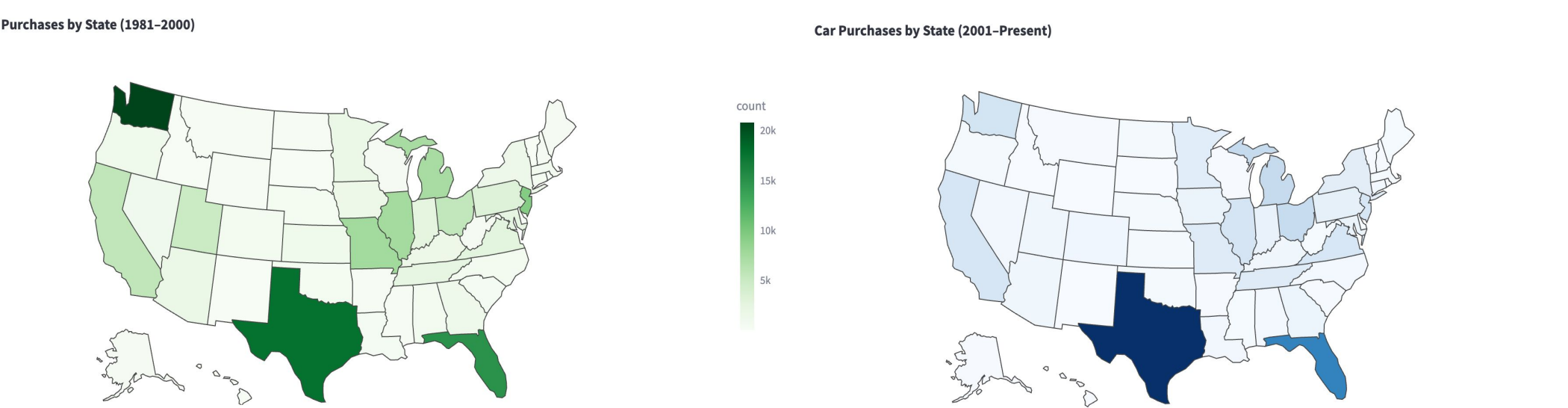
VEH CLASS: CROSOVER STYLECD: CONV FUELTPCD: B

MILEAGECD: 50000

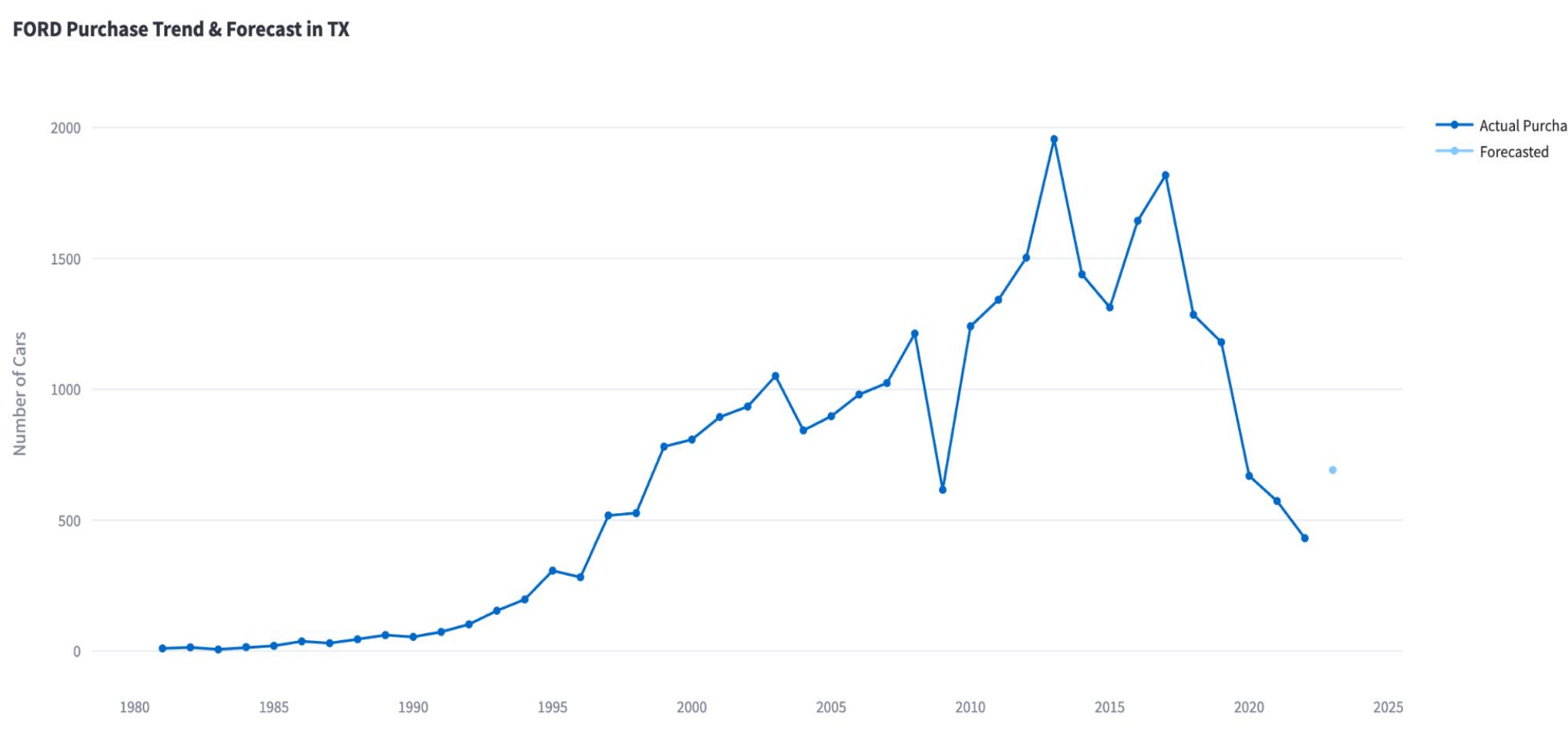
FOR CAR DEALERS

We provide interactive visualizations to track state-level car buying trends, helping dealers identify **hot markets**, anticipate **demand**, and **optimize inventory planning**.

State-Level Vehicle Buying Trends Tracker

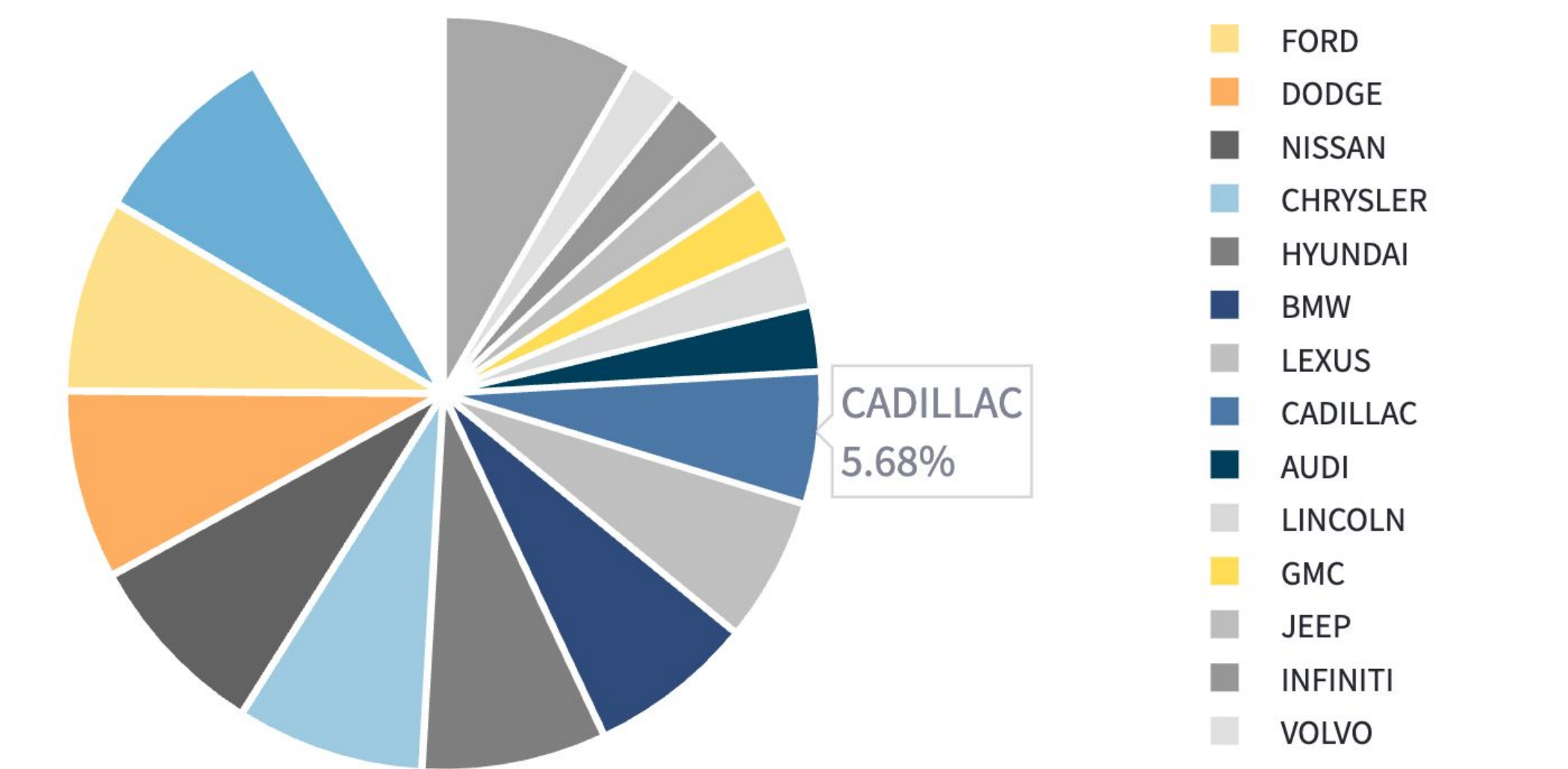


Vehicle Sales Forecast for the Upcoming Year



Inventory Management Recommendations

Brand Distribution

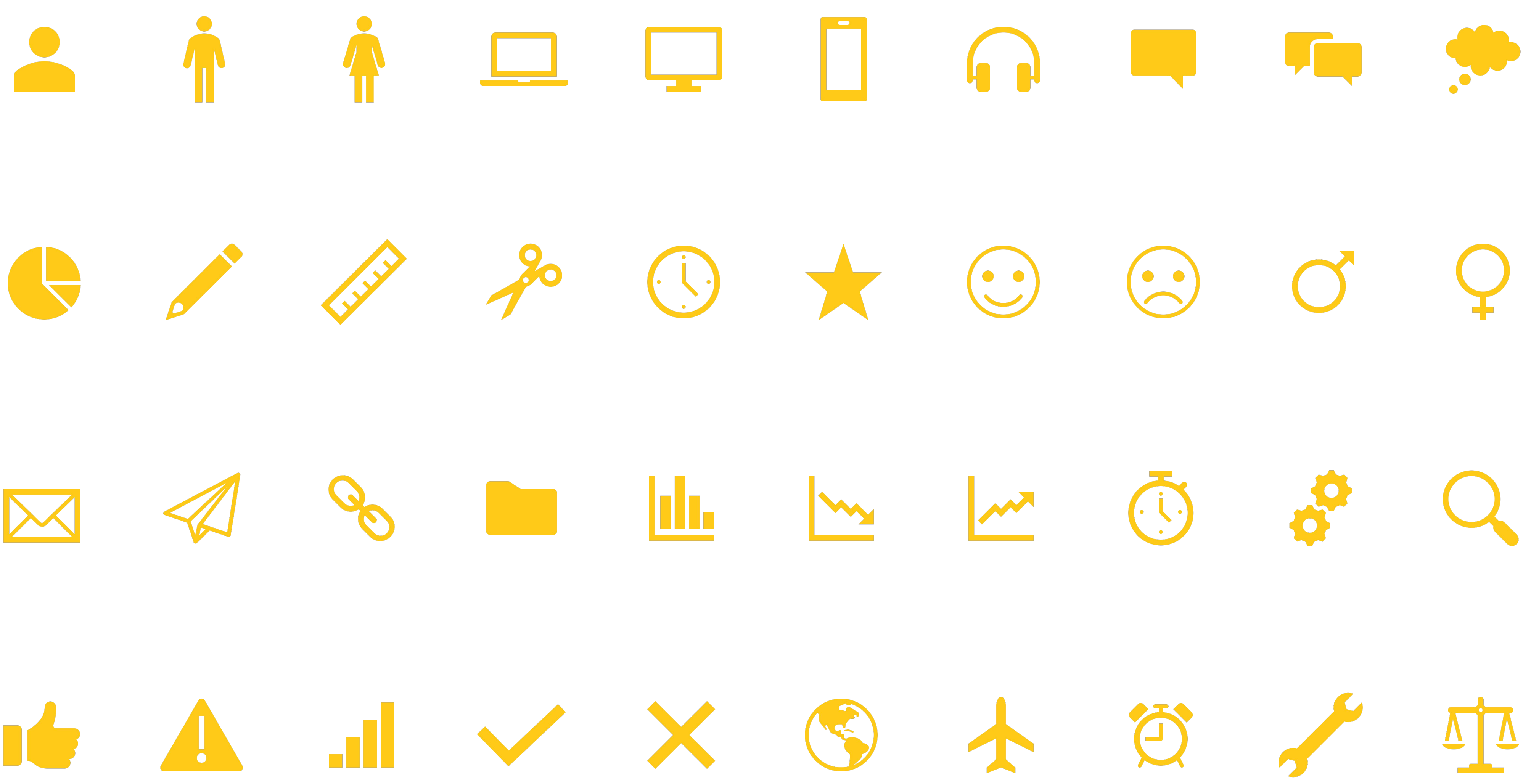


POSTER DESIGN RESOURCES

BLUE ICONS:



YELLOW ICONS:



QUOTED TEXT OR HIGHLIGHTED DATA POINT:

Series: Replace text with quote or data point. Can increase size.

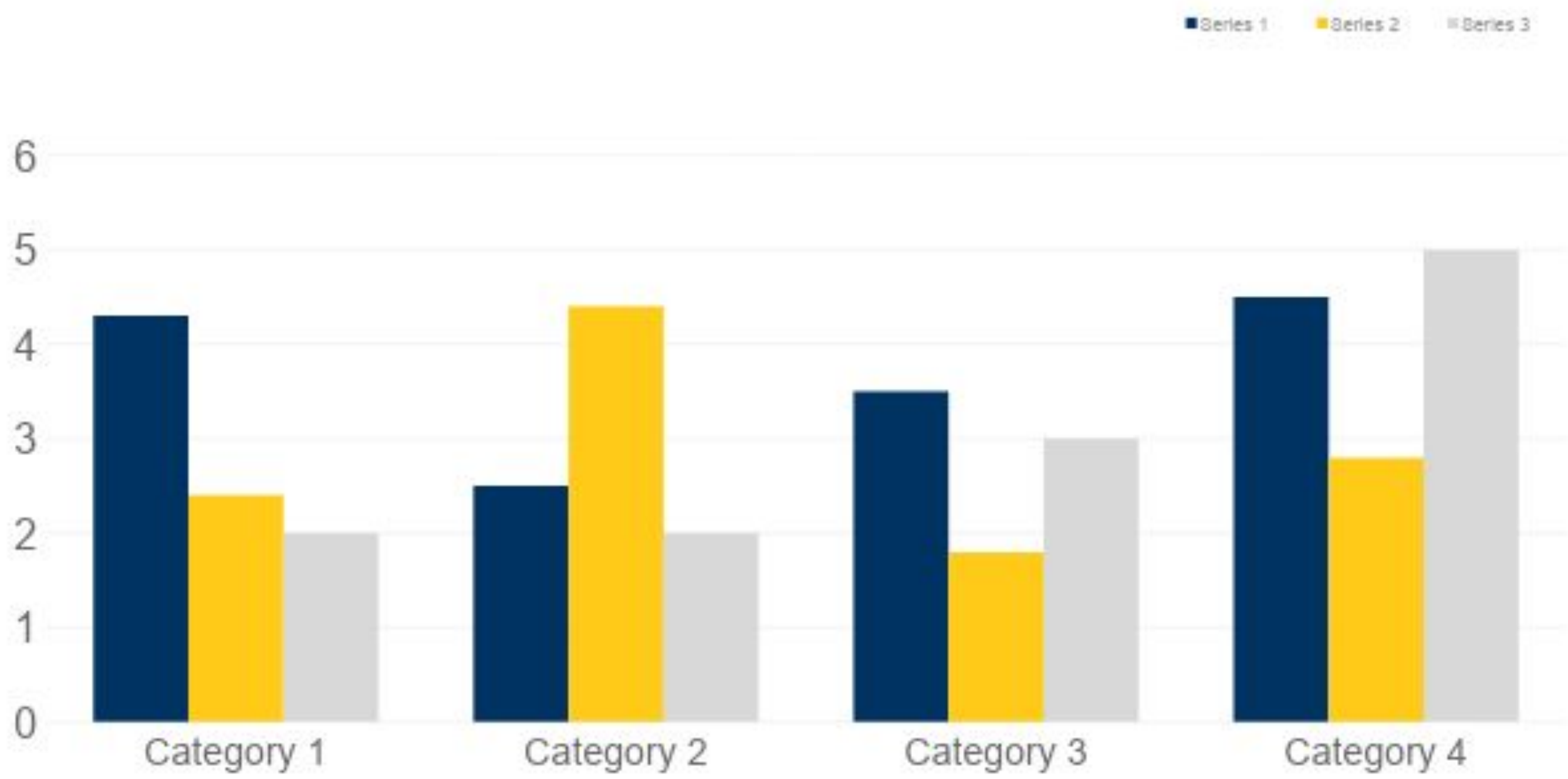
Series: Replace text with quote or data point. Can increase size.

DATA CHARTS (REPLACE WITH DATA)

Chart Title			
8.01	7.99	5.77	6.44
4.50	3.11	9.55	1.12
6.15	8.00	6.18	5.65
8.21	2.16	3.11*	7.17
3.00	9.70	10.50	4.45

Chart Title			
8.01	7.99	5.77	6.44
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Berkeley Logos

