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CITY UNIVERSITY
MALAYSIA
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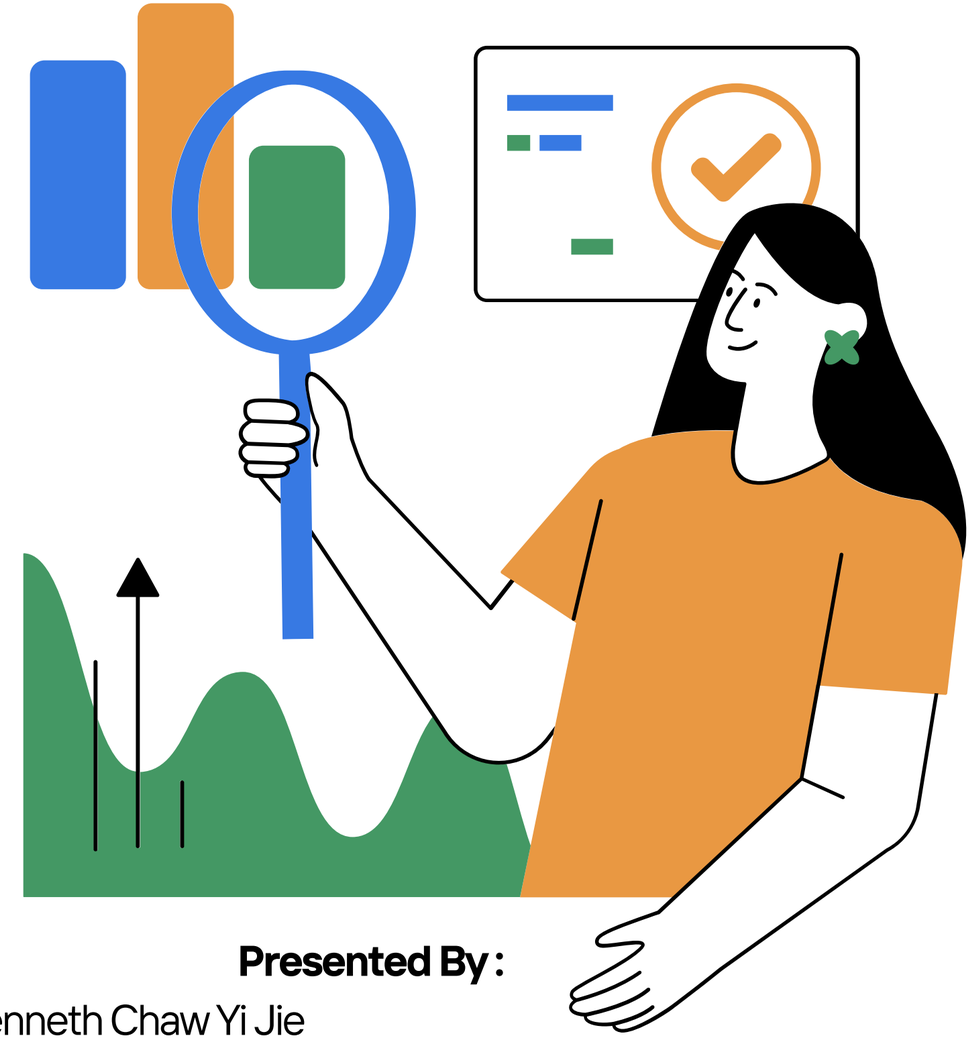
Final Project Modern Data

“Modern Data Exploration with BI Tools”



Presented By :

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Introduction

Objective :

-analyzing a real-world dataset using Business Intelligence (BI) tools.

-simulate a data-driven decision-making process

Dataset Chosen :

-"Retail Sales Data Dashboard" from Kaggle.com

Business Questions :

Q1) How do sales and quantity sold fluctuate over time to identify seasonal patterns?

Q2) Which product categories generate the highest revenue, and what are the best-selling products?

Q3) How does spending behavior differ by gender and age group? Which demographic is the most valuable?

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Business Understanding

Business Objective :

-To leverage data-driven insights to optimize inventory for high-demand periods, reallocating marketing budget

Stakeholders :

-Marketing Director, Head of Sales, Inventory Manager

Business Questions Explanation :

Q1) The Inventory Manager should anticipate the peak sales months to avoid stock-outs and minimize the overstocking in slow periods

Q2) The Head of Sales must identify the winning and under-performing categories in order to adjust procurement strategies and sales focus.

Q3) The Marketing Director requires a clear profile of the highest-spending demographic in order to improve the customer acquisition and retention ROI.

Data Understanding

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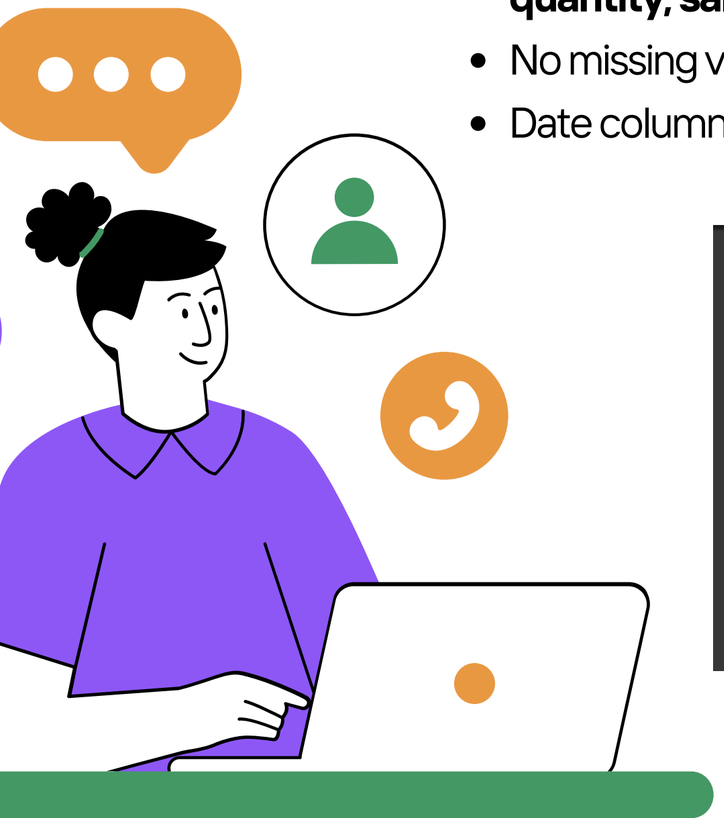
- **Using Google Colab (Write the code)**
- **Dataset:** Retail Sales Data Dashboard (Kaggle)
- **1,000 transactions with:**
  - **i)** Transaction ID, Date, Customer ID, Gender, Age
  - **ii)** Product Category, Quantity, Price per Unit, Total Amount
- Mix of categorical **(e.g., gender, product category)** and numerical **(e.g., quantity, sales)** attributes
- No missing values or duplicates found
- Date column converted from text to datetime for time-series analysis



Choose Files | Copy of Ret... Project.csv

- **Copy of Retail Sales Data Project.csv**(text/csv) - 50605 bytes, last modified: 9/2/2025 - 100% done

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Saving Copy of Retail Sales Data Project.csv to Copy of Retail Sales Data Project.csv
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	Transaction ID	Date	Customer ID	Gender	Age	Product Category	Quantity	Price per Unit	Total Amount
0	1	11/24/2023	CUST001	Male	34	Beauty	3	50	150
1	2	2/27/2023	CUST002	Female	26	Clothing	2	500	1000
2	3	1/13/2023	CUST003	Male	50	Electronics	1	30	30
3	4	5/21/2023	CUST004	Male	37	Clothing	1	500	500
4	5	5/6/2023	CUST005	Male	30	Beauty	2	50	100

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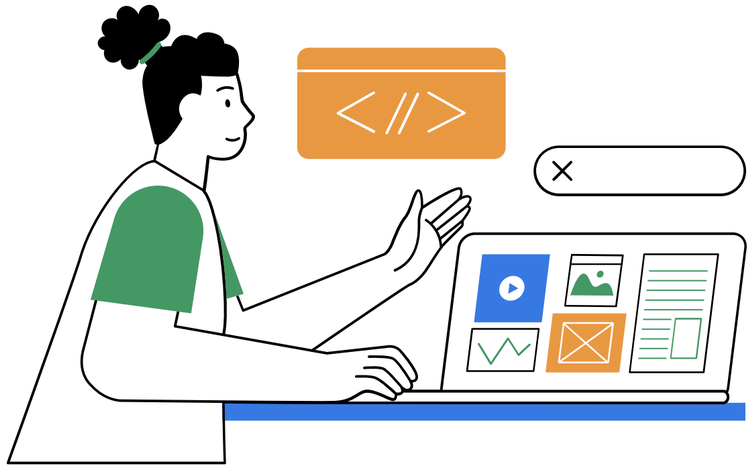
Data Preparation



- **Column names standardized** → lowercase, snake_case
- **Date converted to datetime** → extracted: year, month, day, quarter, month_year
- **Numeric validation:** quantity, price_per_unit, total_amount → converted to numeric
- **Feature engineering:**
  I) sales_per_unit = total_amount ÷ quantity
- Final cleaned dataset saved as clean_retail_data.csv
- Ready for Python analysis & Looker Studio dashboards

	transaction_id	date	customer_id	gender	age	product_category	quantity	price_per_unit	total_amount	year	month	day	quarter	month_year	sales_per_unit
0	1	2023-11-24	CUST001	Male	34	Beauty	3	50	150	2023	11	24	2023Q4	2023-11	50.0
1	2	2023-02-27	CUST002	Female	26	Clothing	2	500	1000	2023	2	27	2023Q1	2023-02	500.0
2	3	2023-01-13	CUST003	Male	50	Electronics	1	30	30	2023	1	13	2023Q1	2023-01	30.0
3	4	2023-05-21	CUST004	Male	37	Clothing	1	500	500	2023	5	21	2023Q2	2023-05	500.0
4	5	2023-05-06	CUST005	Male	30	Beauty	2	50	100	2023	5	6	2023Q2	2023-05	50.0

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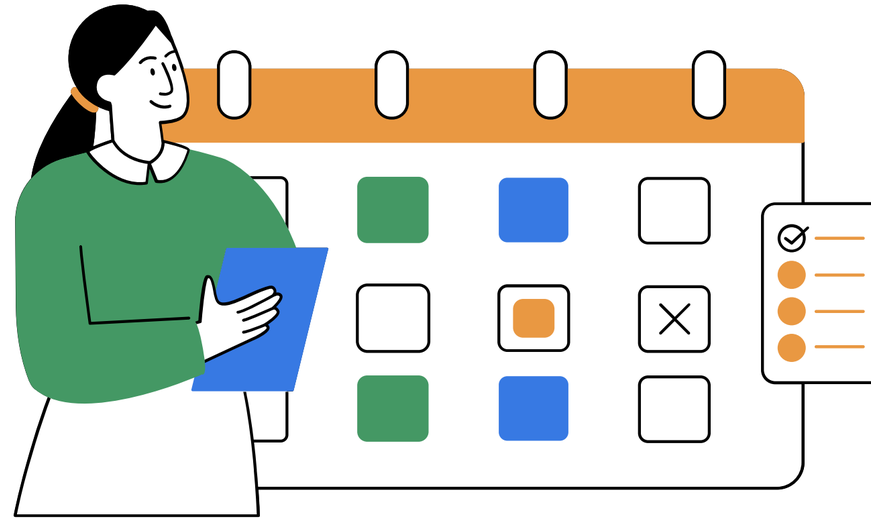
Data Analysis & Methods



- Applied descriptive analytics to extract business insights
- Created summary tables for later BI dashboards (Just for references)
- Analysis focused on overall, monthly, category, customer, and daily sales

Overall Summary (Figure 6)

- Total Sales
- Total Quantity Sold
- Number of Customers
- Number of Transactions
- Average Sales per Transaction

	total_rows	total_sales	total_quantity	num_customers	num_transactions	avg_sales_per_transaction
0	1000	456000	2514	1000	1000	456.0

Monthly & Category Analysis

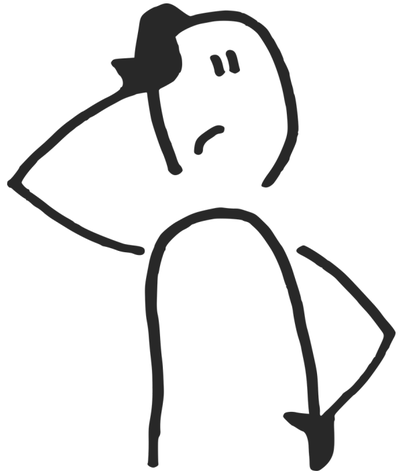
- **Monthly Summary (Figure 7)**
  - Trends in sales, quantities, and customer activity
  - Useful for detecting seasonality & sales growth

	month_year	total_sales	total_quantity	avg_sales	num_customers
0	2023-01	35450	195	466.447368	76
1	2023-02	44060	214	518.352941	85
2	2023-03	28990	194	397.123288	73
3	2023-04	33870	214	393.837209	86
4	2023-05	53150	259	506.190476	105

- **Category Summary (Figure 8)**
  - Top performing product categories
  - Underperforming categories identified for improvement

	product_category	total_sales	total_quantity	avg_price	num_customers
0	Beauty	143515	771	184.055375	307
1	Clothing	155580	894	174.287749	351
2	Electronics	156905	849	181.900585	342

Customer & Daily Analysis



Customer Summary (Figure 9)

- Total spending per customer
- Quantity purchased, avg. order value, transactions per customer
- Helps identify high-value customer

	customer_id	total_sales	total_quantity	avg_order_value	num_transactions
0	CUST001	150	3	150.0	1
1	CUST002	1000	2	1000.0	1
2	CUST003	30	1	30.0	1
3	CUST004	500	1	500.0	1
4	CUST005	100	2	100.0	1

Daily Summary (Figure 10)

- Day to day sales trends
- Detects short term fluctuations & anomalies

	date	total_sales	total_quantity	num_customers	num_transactions
0	2023-01-01	3600	10	3	3
1	2023-01-02	1765	10	4	4
2	2023-01-03	600	2	1	1
3	2023-01-04	1240	8	3	3
4	2023-01-05	1100	5	3	3

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Business Intelligence (BI) Dashboard

Key Performance Indicators (Top Row)

- Total Sales: 456.0K - representing total revenue
- Total Quantity: 2.5K - total number of items sold
- Average Sales per Transaction: 456.0 - indicating the average transaction value

Sales Trend Over Time (Left Chart)

This line graph tracks the total quantity sold from January 2024 back through 2023. Key observations:

- Seasonal Patterns: Shows significant fluctuations with peaks around September 2023 and May 2023
- Recent Performance: Sales appear to have stabilized around 200 units in the most recent period (January 2024)
- Volatility: The trend shows considerable variation, ranging from lows around 175 to peaks over 250 units

Revenue by Gender (Top Right Pie Chart)

- Female customers: 51.1% of total revenue
- Male customers: 48.9% of total revenue
- Gender Balance: Nearly even split with females contributing slightly more to overall revenue

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Business Intelligence (BI) Dashboard

Best-Selling Products (Bottom Left Bar Chart)

- Product performance by total quantity sold:
- Clothing: Leading category with approximately 800+ units
- Electronics: Close second with around 700+ units
- Beauty: Third place with approximately 600+ units

Revenue by Category (Bottom Center Treemap)

Visual representation of revenue distribution:

- Electronics: Appears to dominate revenue share despite lower quantity
- Clothing: Significant revenue contributor
- Beauty: Smaller revenue share compared to the other categories

Average Spend by Age Group (Bottom Right Bar Chart)

- Shows spending patterns across age demographics (19-53 years):
- Peak Spending: Age 37 shows the highest average spend at around 750
- Consistent Spending: Most age groups maintain spending levels between 600-700
- Age Range: Covers a broad demographic from young adults to middle-aged customers

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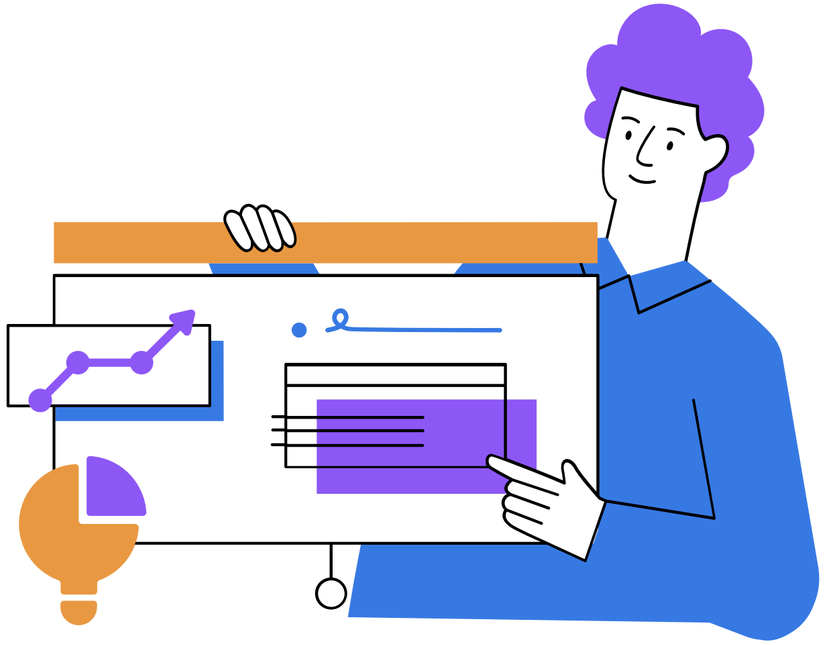
Findings & Insights



Business Performance

1. Strong Transaction Value: With an average of 456.0 per transaction, the business maintains healthy transaction sizes
2. Balanced Customer Base: The nearly 50-50 gender split indicates broad market appeal

Product Strategy Insights

1. Volume vs. Value Discrepancy: While Clothing leads in quantity sold, Electronics appears to generate more revenue per unit, suggesting higher-margin products
2. Category Opportunities: Beauty products show potential for growth, given lower quantities but established customer interest

Customer Demographics

1. Peak Spending Age: The 37-year age group represents the highest-value customer segment
2. Broad Appeal: Consistent spending across age groups from 19-53 suggests the product mix appeals to multiple generations

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Recommendations

1.Boost High-Value Electronics

Increase marketing focus for Electronics; feature prominently online.

2. Target Key Customer Group

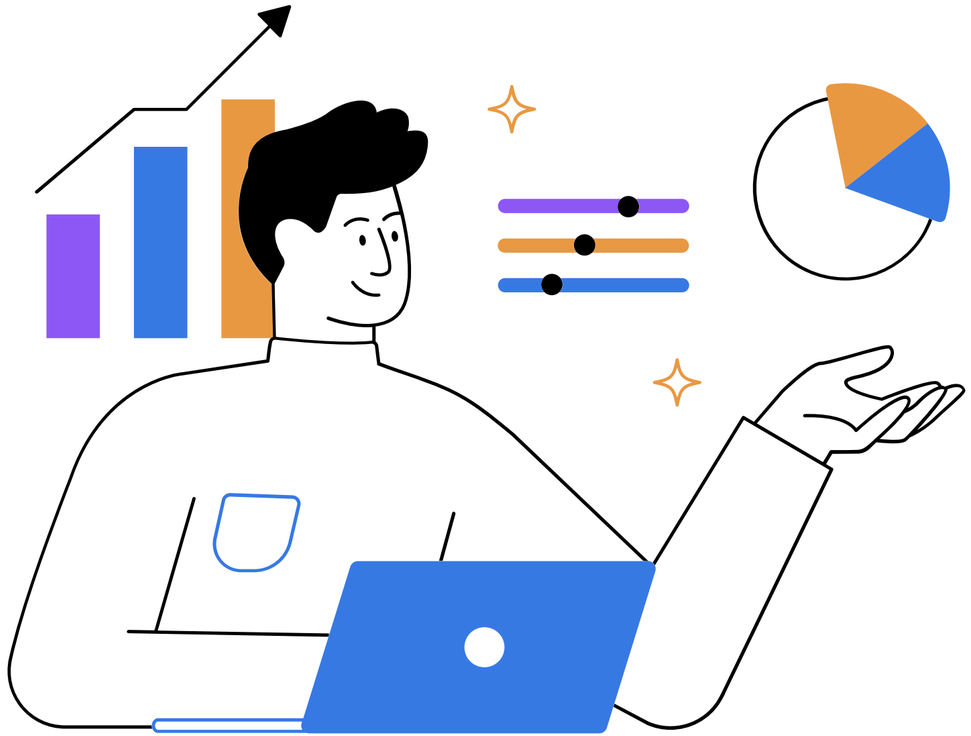
Launch personalized email & loyalty campaigns for customers aged 34-43.

3. Optimize Peak-Season Inventory

Conduct pre-peak inventory review in October; secure stock for best-sellers.

4. Revitalize Beauty Category

Bundle Beauty products with top-selling Electronics; investigate pricing.



Recommendations & Impact

Impacts:

1.Focus resources on the most profitable product category.

2. Strengthen engagement with the highest-spending demographic.

3. Prevent stock-outs and reduce emergency costs during peak demand.

4. Stimulate sales in the underperforming Beauty category and improve overall brand appeal.

Conclusion

This project demonstrates:

- BI analytics transform data into actionable strategies
- Electronics drives high-value revenue
- Beauty category offers growth potential
- 37-year-olds are highest-value demographic
- Multi-generational appeal exists across age groups

Recommendations provide clear roadmap for:

- Increased profitability
- Operational efficiency
- Competitive advantage

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Thank You All !