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LSE Course 3: Predictive Analytics

Assignment 3 Report

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# Background

Turtle Games is a game manufacturer and retailer that sells own products and products manufactured by other companies. They offer three product categories: Lego, various toys and games, and video games. As a global company, they have an objective of improving overall sales performance based on data analysis of price, customer sentiment and global sales forecast. This report will detail the methodology used to conduct analysis, insights, and predictions of sales.

# Approach & Visualisation

Github link: <https://github.com/hazz292/LSE_DA_Assignment_3_Turtle_Games>

There are three aspects to analyse the dataset and improve sales performance. Firstly, simple and multiple linear regression functions in python are used to build a pricing model for lego products based on pieces and customer age. R tidyverse package is used to analyse the age group most likely to leave reviews and highest price point customers age 25 or above are willing to purchase. Secondly, R Natural Language Toolkit is used to conduct sentiment analysis and understand feedback from customers who purchased various toys and games. Thirdly, multiple linear regression in R is used to predict total global sales of video games based on Europe and North America sales.

## A3\_Week\_1.ipynb

To predict the optimal price for lego products with 8000 pieces, pricing trend needs to be identified before creating simple and multiple linear regression models for prediction.

Using describe function in python, the price ranges from USD 2.27 to max USD1104 with a mean of USD65.

Table

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Using seaborn package to create histogram and boxplot, price distribution is strongly skewed to the right with a long tail on the positive side. Majority of the lego is priced between USD 20 to 70, while outliers represent expensive products from USD 180 to USD 1100.

Chart

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Chart, calendar

Description automatically generated

Graphical user interface, text, application

Description automatically generatedA subset with price as x and pieces as y is created to build simple linear regression model and split into train (70%) and test (30%) sets to validate accuracy of the model.

Train data set is fitted with linear regression.

Graphical user interface

Description automatically generated with low confidence

A scatter plot is created to visualize relationship the positive relationship between price and pieces of train set. A strong R-squared value signifies an increase in pieces explains 76% variation, increase, in price.

Chart, scatter chart

Description automatically generated

Graphical user interface, text, application, email, Teams

Description automatically generatedWith the intercept and coefficient value, the predict function is used to predict price of 8000 pieces lego. According to the training model, the optimal price is USD797.

Chart, scatter chart

Description automatically generatedTo validate the model, the test set is used to predict the price, resulting in USD 783 which is similar to USD 797.

Graphical user interface, text, application, Teams

Description automatically generated

Subset is created to include three variables, price, pieces, and age. Multiple linear regression model is built based on train set with a strong R-square of 0.76 meaning pieces and age explains 76% of price variation. Predicted price for 8000 pieces of lego purchased by 30 years-old is USD783.

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, text

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Test set is fitted into the model predicting optimal price at USD 814 which is similar USD783.

Graphical user interface, text, application, email

Description automatically generated

## A3\_Week\_3.ipynb

Natural language processing is applied to analyse customer reviews of various toys and games and identify areas for improvement to satisfy customer and maximise sales.

Using python, game\_reviews dataset is imported and viewed. Subset with only full reviewText is created, since summary is too short and cleaned by removing missing values, convert all text to lowercase, remove punctuation marks and duplicates. Graphical user interface, text, application

Description automatically generated

Chart, bar chart

Description automatically generatedText

Description automatically generated with low confidenceNext, text is pre-processed using tokenisation to calculate the frequency distribution of words. Each sentence is split into individual tokens, added into one list using for loop and plotted. As there are many stopwords such as “and”, “the” affecting results, they are removed and clean tokens are visualised with WordCloud. Words with higher frequency are larger such as “game”, “play”, “great”.

Polarity score is generated using textblob library and plotted onto histogram and boxplot. Overall, majority of reviews are slightly positive with polarity score mainly between 0 to 0.25.

Chart, histogram

Description automatically generated

Chart, box and whisker chart

Description automatically generated

Graphical user interface, text, application, email

Description automatically generatedTo understand reason behind positive sentiment, the top 20 positive reviews are extracted. Using document-term matrix to extract the positive features, most top reviewers thought games are “awesome”, “perfect” and “wonderful”.

Chart

Description automatically generated

Graphical user interface, text, application

Description automatically generatedTop 20 negative reviews are extracted based on negative polarity score and most reviewers were “disappointed” and mentioned “box”, “book”, “elf”.

Chart, bar chart

Description automatically generated

## A3\_Week\_4.R

R Tidyverse package is used to wrangle and visualise lego data set to understand which age group is most likely to leave reviews and which most expensive price point is purchased by customer above age 25.

The lego data set is imported, viewed using as\_tibble function, and check for missing values. Then, qplot function is used to view distribution of age variable using boxplot. Majority of customers are aged between 10 to 25.

Chart, histogram

Description automatically generated

Column graph identified that age 8 customer left the most reviews.

Chart, histogram

Description automatically generated

A new column is added to age\_df to map the corresponding customer age into 6 groups and aggregate by age\_group.

Text

Description automatically generated with medium confidence

Column graph identifies customers age 6-10 are most likely to leave reviews, then followed by age 26-30.

Chart, bar chart, histogram

Description automatically generated

Subset with customer older than age 25 is created to identify highest price point accepted. Dataframe is aggregated by age and summarised by maximum price. Column graph indicates age 29 customers purchased the most expensive lego product at USD260, then age 25 customers at USD195.

Chart, bar chart, histogram

Description automatically generated

## A3\_Week\_5.R

Game\_sales subset is created with relevant variables = and cleaned by identifying missing values.

Global sales, North America and Europe sales distribution are visualised using histogram and boxplot of ggplot. All sales distribution is extremely skewed to the right due to extreme outliers as identified by upperbound calculated using interquartile range. Outliers are included as they represent the best-selling products.

Majority of global sales is between 0.06M to 1M units with outlier of 82M, high skewness of 17.34 and heavy kurtosis of 606.75.

Text

Description automatically generatedGraphical user interface, text, application

Description automatically generated

A picture containing text, white

Description automatically generatedChart

Description automatically generated

Majority of NA sales is between 0.01M to 0.6M units with outlier of 82M, high skewness of 18.79 and heavy kurtosis of 651.

Graphical user interface, text, application

Description automatically generatedText, letter

Description automatically generated

Chart, bar chart, histogram

Description automatically generatedA picture containing text, white

Description automatically generated

Majority of EU sales is between 0.01M to 0.27M units with outlier of 29M, high skewness of 18.87 and heavy kurtosis of 758.80.

Text

Description automatically generatedText

Description automatically generated

Chart, histogram

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A picture containing graphical user interface

Description automatically generatedScatterplot shows a strong positive relationship between North America, Europe and Global sales with a correlation coefficient of 0.9 which is very close to 1.

Text

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Chart, scatter chart

Description automatically generatedChart, scatter chart

Description automatically generated

## A3\_Week\_6.R

Multiple linear regression model is built using lm function to predict global sales, dependent variable, based on North America and Europe sales, independent variable, to minimise production waste.

Graphical user interface, text, application, email

Description automatically generated

Multiple R-squared 0.96 is very strong and close to 1, meaning North America and Europe sales explains 96% of Global sales variation. Residual standard error is quite small meaning regression model fit dataset closely.

Text

Description automatically generated

Total dataframe is created by aggregating sum of global, NA and EU sales of all games. Predict function generates outcome 8340M which is close to actual value 8920M.

Graphical user interface, text, application, email

Description automatically generated

Graphical user interface, application

Description automatically generated

# Predictions

As predicted using linear regression model, lego price should increase as pieces and age increase assuming positive linear relationship. Business should price lego with 8000 pieces at USD783 and if customer is age 30, price at USD 814. Identifying optimal price points will enable business to align with customers’ perceived value of products, increase likelihood of purchase and maximise sales.

Business should improve product features based on customer reviews to satisfy demands with attractive product offerings. Overall review sentiment is slightly positive with polarity score between 0 to 0.25. Based on top negative review analysis, business should improve quality of box packaging and books materials to improve sales performance.

Customers age between 6-10 left most reviews of 76,120. Further analysis can be conducted to understand if they are frequent customers. Age 29 customers purchased most expensive lego product at USD260, then age 25 customers at USD195 signifying higher purchasing power. Business should target expensive product range for older customers.

Lastly, based on EU and NA historic sales, global sales of all video games are predicted to reach 8340M units in next financial year. Business should take forecasted sales into consideration when sourcing and manufacturing units to ensure enough inventory to capture potential sales.