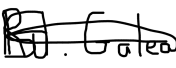




RESEARCH PROPOSAL FORM

(also referred to as the 'Statement of Intent Form', or SOI)

To be submitted by the researcher to the Institute Research Sub-Committee (IRC)

Research Title: Forecasting sales for aesthetic products using Machine Learning	
Institute name Institute of Information & Communication Technology	
Course / Programme: B.Sc. Business Analytics (Hons.)	
Level and year of study Level 6 Year 3	
Main area of study being proposed: <p>In this study, aesthetic sales data ranging from 2015 to 2022 will be analysed for various patterns such as seasonality and any other possible events. Time Series modelling will be used to find out trends and patterns during the different times of the year. The Covid-19 sales period will also be considered and looked into to find out how (if any) it impacted the company sales. Sales of aesthetic products will also be analysed using Machine Learning algorithms in order to see if future sales can be forecasted to reduce costs and meet demand in a most efficient manner. After the study is completed, surveys will be distributed in Malta to find out if Covid-19 impacted the local aesthetic clinics.</p>	
Name of Researcher: Rushayal Galea Massa	Researcher's I.D. Number: 364201L
Signature of Researcher 	Date of submission of Form 24/10/2022
Name of Tutor (or Recommended Tutor): Alan Gatt	

Personal Motivation for the Choice of Research Theme.

Sales forecasting is used in many businesses nowadays as this helps when ordering and producing certain products, especially the ones which have a short expiration date. A personal contact is working in a company that distributes aesthetic products mainly across the United Kingdom and a few other countries such as USA and Brazil. I would like to use data analysis techniques to identify patterns in data. Machine Learning forecasting technique will also be used to help them formulate a better marketing and supply strategy depending on the current and future market demand.

Outline of Key Literature and Theoretical Framework or Propositions.

Machine Learning

Machine Learning is one of the most popular technologies for data mining. It is used to solve difficult or complex problems by training and evaluating a machine learning model. Some of the most popular supervised methods are tree-based machine-learning algorithms, e.g., Random Forest, Gradient Boosting Machine (Pavlyshenko, 2019). The data is split into two parts, the major being the training data and the minor being the test data. The training phase is essential so that the machine learning algorithm can evaluate data, find patterns, and obtain a prediction model that can be used to make certain predictions. After the training is done, the testing phase is carried out, by using the trained model on the unseen test data. In doing so, one can find out how reliable and accurate the model is by comparing the results of the algorithm with the labels of the real data.

How machine learning is used for forecasting

At present, the most commonly used forecasting method of sales forecasting is time series modeling (Wei & Zeng, 2021). This is used when the data is non-stationary and must be analysed during particular time intervals due to imbalances caused by holidays, seasons, and other events (which in this study will be the lockdown period for COVID) (Hou et al., 2021). The most important features of this data will be determined later on in the study. Since this study will focus on transaction data, in order for forecasting to work, the data must be in a chronological order and the different time stamps should be equidistant. Missing values should not be present in the dataset as this will alter the forecasting accuracy. The algorithm will identify any trends and patterns from the dataset so that in the testing phase, it can predict the future data. New approaches are more suitable when having multiple time series with different categorical variables in the dataset.

Forecasting sales or demand

Sales forecasting is used in enterprise businesses to predict their future sales depending on their past sales. Forecasting can also be used to design a better marketing strategy to increase their sales by grasping the market demand. (Wei & Zeng, 2021)

Importance of sales forecasting (for aesthetic products)

Once produced, the average shelf life of an unopened aesthetic product is around 2 years. A company that sells these products cannot afford to over-order due to the short expiration date. When a customer purchases these types of products, they would not expect the product to expire in just a couple of months. On the other hand, if the company does not satisfy the market demand, customers will have to purchase from competitors, which will result in loss of sales and possibly even losing the customers' loyalty (Aqil Burney & Mubashir Ali, 2020)

Lockdown affecting sales

During the lockdown period, the sales of beauty related products was not as successful as the pre-pandemic period. One of the biggest negative impacts on the facial aesthetics industry during 2020 was the UK lockdown (Singh, 2021). This was the major factor which caused this decrease in sales. Lockdowns were enforced in many counties which led to having a lot of people working from home and shops which had to be closed for a period of time. People could not purchase beauty products from shops and there were no clinics performing beauty services such as dermal fillers. When the use of face mask was mandatory, not everyone was putting on makeup and opting for beauty services.

Significance of the Study.

This study is significant since the business being researched will have a detailed analysis of the supplies sold during different times of the year. The company will know more regarding which seasons are more successful and which are the most sold products.

Another significant finding will be the impact of the Covid-19 pandemic and if it had affected their sales in any way. The findings will also be compared between different regions across the UK to determine how they were impacted.

Hypotheses and/or Research Question/s

- Did the Covid-19 lockdown affect the sales of aesthetics products?
- Did the Covid-19 pandemic have the same impact on all the regions in the UK?
- Can machine learning algorithms be used to make a prediction for supply based on previous transactions?

Target Participants and Research Methods for Data Collection and Analysis

The sales in this dataset are from different suppliers and doctors across different cities in England and Ireland. These will be used to predict the sales for future months depending on the past sales.

Questionnaires will be sent to aesthetic clinics and distributors in Malta to find out how the pandemic affected their businesses locally.

**Anticipated Contributions of the Study.**

At the end of this study, my anticipated contribution will be to have a sales forecast for this chosen company. This will be helpful to them so that when they are placing an order for the aesthetics products, they will have an estimated quantity of the products that will be sold in the coming months. This will reduce the chances of overordering too much aesthetic products and wasting resources. This study is very significant since these aesthetics products do not have a long expiry date.

Another contribution will be to find out which product categories are most popular. Since this company provides training seminars regarding how the products are made and how they are used, they can focus more on the popular products.

Dissertation Project Plan.

	Description	2022		2023					
		Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	Project Commencement								
1	Idea formulation and proposal								
	1.1 Discussion with lecturers								
	1.2 Initial mentor meetings								
2	Literature Review								
	2.1 Datasets								
	2.2 Tutorials								
	2.3 Papers								
3	Research Methodology								
	3.1 Research Questions								
	3.2 Carrying out surveys								
	3.3 Data approach and evaluation								
4									
	4.1 Experimental prototype								
	4.2 Predicted Sales								
5	Deliverables								
	5.1 Dissertaion								
	5.2 Paper								
	5.3 Viva								
	Project Closure								



Ethical Considerations.

Refer to guidance points below. You are also additionally required to read MCAST Document 074 'Research Ethics Policy and Procedure' that is available on the College website

Research shall be conducted in such a manner so as to avoid any psychological and physical harm to humans and animals and financial damage to organizations:

- 1. Only the supervisor and examiners will have access to any data gathered.*
- 2. Participants will remain free to withdraw from the study at any time without having to provide any reason. In the case of withdrawal, all the records and information collection will be deleted.*
- 3. The participant, who is the sole proprietor of the data provided, is granting that such data would be processed for this study purposes only.*
- 4. The data collection process will be a transparent process.*
- 5. All transcriptions and/or electronic recordings reflecting the data collected, once exhausted, are to be deleted*
- 6. Confidentiality, anonymity and data protection procedures are to be ethically abided by.*
- 7. The researcher would provide a soft copy of the study to the participant, if required.*

Enter details here regarding possibility of issues regarding confidential personal data:

The data which will be collected from the datasets will have no personal data included in it as only products will be listed and noted. (During the Surveys, no personal data will be asked such as names or contact info, they will be anonymously submitted.)

Enter details here regarding possibility of physical harm:

All the research which will be carried out will be done using a computer, so there is no possibility of physical harm. This section is not applicable.

Enter details here regarding possibility of moral harm:

No moral harm will be caused as this research is only focusing on sales of aesthetic products from a company's dataset.

Enter details here regarding possibility of business harm:

No details regarding ideas and data of the business being researched will be published. This means that the business name will not be mentioned, and the product names will also not be included in the paper. This way the participant will not suffer any competitive disadvantage as an outcome of my research.

Please see **Annex 1** for a sample Participant Information Letter and **Annex 2** for a sample Participant Consent Form. Student is to submit a copy of the proposed Participant Information Letter and Participant Consent Form where applicable. Both documents should be attached to the end of the SOI that is being submitted by the student.

List of Key References:

<https://www.mdpi.com/2306-5729/4/1/15>
<https://iopscience.iop.org/article/10.1088/1742-6596/1754/1/012191/meta>
<https://ieeexplore.ieee.org/document/9523500>
<https://ieeexplore.ieee.org/document/7154749>
<https://ieeexplore.ieee.org/document/9024810>
<https://ieeexplore.ieee.org/document/9824863>
<https://www.botulinumtoxclub.co.uk/blog/how-has-covid-affected-facial-aesthetics/>

This section is to be filled in by the representative of the Institute Research Sub-Committee (IRC) prior to forwarding of this Form to the 'MCAST Research Ethics Committee' for final ethics approval:

Nature of Ethical Consideration	Outcome (Tick)	Comments/Advice
All ethical issues have been adequately tackled.		
Possibility of issues regarding misuse of data or some form of harm.		

Details of Representative to the Institute Research Sub-Committee.	
Name	Signature
Designation	Date

Annex 1: Participant Information Letter

Sample:

Title of Research: _____

You are being invited to take part in a research study. Before you decide to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information.

What is the purpose of the study?

This research is being undertaken on...

Why have I been chosen?

You have been chosen because...

Do I have to take part?

It is up to you to decide whether or not you take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a corresponding consent form.

What will happen to me if I take part?

You will then be given a questionnaire on.../your data will be used.../your image will be used...

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?

By taking part you will be contributing to the development of a set of recommendations for...

What if something goes wrong?

If you wish to complain or have any concerns about any aspect of the way in which you have been approached or treated during the course of this study, please contact...(researcher is to give his/her MCAST email as a contact)

Will my details be kept confidential?

All information which is collected about you during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information and will not be shared with any other individuals. Participants should note that data/images collected from this project may be retained and published in an anonymized form. By agreeing to participate in this project, you are consenting to the retention and publication of data.

What will happen to the results of the research study?

The results will be written up into a dissertation for my final project of my Bachelor...

Who is organizing the research?

The research is conducted as part of a degree in ...

Who may I contact for further information?

If you would like more information about the research before you decide...(researcher is to give his/her MCAST email as a contact)

Thank you for your interest in this research...



Annex 2: Participant (or Guardian) Consent Form



Sample:

Title of Research: _____

Name of Researcher: _____

Please initial box

- | | |
|--|--------------------------|
| 1. I confirm that I have read and understand the Information Letter for the above study and have had the opportunity to ask questions. | <input type="checkbox"/> |
| 2. I understand that my/my charge's participation is voluntary and that I/my charge am/are free to withdraw at any time without giving any reason. | <input type="checkbox"/> |
| 3. I agree to allow my daughter/son/charge to take part in the above study. | <input type="checkbox"/> |

(Statement 3 is to be included only when guardians/parents are involved in giving consent)

Name of Participant/
Guardian

Date

Signature

Researcher

Date

Signature

1 for participant; 1 for researcher