

Prom02 – Appendices

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Programme: MSc Data Science

1. Project Achievements, Challenges and Impacts

1.1 Achievements

After all, Ambros instructed me to prepare such research, and their main goal might be to develop an option which relied on professional services which could be less depend on machine learning result and build a data product. Hence, I have three critical points that I should communicate my success in this research to drive the new product – Machine Learning as SaaS instead of developing a professional service team.

Achievement	Significance	Skills & Knowledge	Evidence
The result provided a great machine learning model for customer who needs to understand the pattern of opening a new restaurant.	According to the practice of this research, it may become F&B industry knowledge for restaurants to source a new location.	-F&B domain knowledge -Excel, Python and Data cleaning -Data analysis -ML algorithm selection -Problem solving skills	Brown and Mitchell, 1993 Ayyadevara, 2018 Kim and Gu, 2006 Refer to Chapter 4
Better prediction of restaurant sales and customer service based upon earlier customer behaviour data.	For restaurant operators who need to plan forward for future expansion or cost savings, restaurant sales forecasts are a critical consideration factor.	-Feature engineering -ML algorithm selection and cross validation -Data Modelling -Time management	Tanizaki et al., 2019 Lasek et al., 2016a Refer to Chapter 3
Ambros will offer restaurant owner truly personalized services recommendations	It enables Ambros to be more competitive in the industry by adding additional value to their existing SaaS product.	-Algorithms & Optimization -Python programming -Data structures -Problem solving skills	Mathur, 2018 , Lian et al., 2017b , Lian et al., 2017a , Refer to Chapter 2 and 3

1.2 Challenges

Challenge	Explanation	Approach & Solutions	Evidence
Data Collection	Find data, consolidate those data from Ambros, Government and Property agency from web scraping spent a lot of time which over 50%-60% of the research. Once the data is collected, validation of those data quantity is sufficient also.	<ul style="list-style-type: none">-Data cleaning with excel and Python tools-Dimensionality reduction, remove some variable which may not affect the result.-Instance selection, it aims to reduce a dataset's height. Diverse and include random selection, genetic algorithm based selection, progressive sampling, using domain knowledge and cluster sampling.	L'heureux et al., 2017 Refer to Chapter 2.2
Selection of Machine Learning Models	Model selection is the process of evaluating or assessing candidate models in order to select the best one. Whereas, once a model has been selected, it can be evaluated in order to communicate how well it is expected to perform in general.	<ul style="list-style-type: none">-A model that satisfies the needs and constraints of Ambros expectation.-Split the data into training, validation, and test sets, then fit candidate models on the training set, evaluate and select them on the validation set, and report the performance of the final model on the test set.	Kim and Gu, 2006 Refer to Chapter 2.3
Python programming and debugging	When fine tuning the data csv during the training phase. The python code is essentially changing or evolving as the model trains. A lot of parameters or wights in the model are changing in every step during training. It shops changing once training is complete, at which pint what bugs I didn't catch during the training are part of the model.	I must be able to capture model and optimizer specific information during training. Monitor and react to changes in the capture data with assertion rules that get triggered when a condition is met, eg. over fitting.	Mathur, 2018 Refer to Chapter 3

1.3 The Project/Research - Advancing Knowledge and Skills

The impact of this research on me are that best practice flow is used to calculate the restaurant status and predict the sales forecast of a restaurant using machine learning regression models. These studies can also include a literature review and demonstrate the whole technology for achieving the best results for certain industries, eg. F&B. This journey begins only and every year the field of machine training grows fast. I should stay on top of all related news and learn how to produce the best machine learning algorithms in varies industries.

2. Project Management

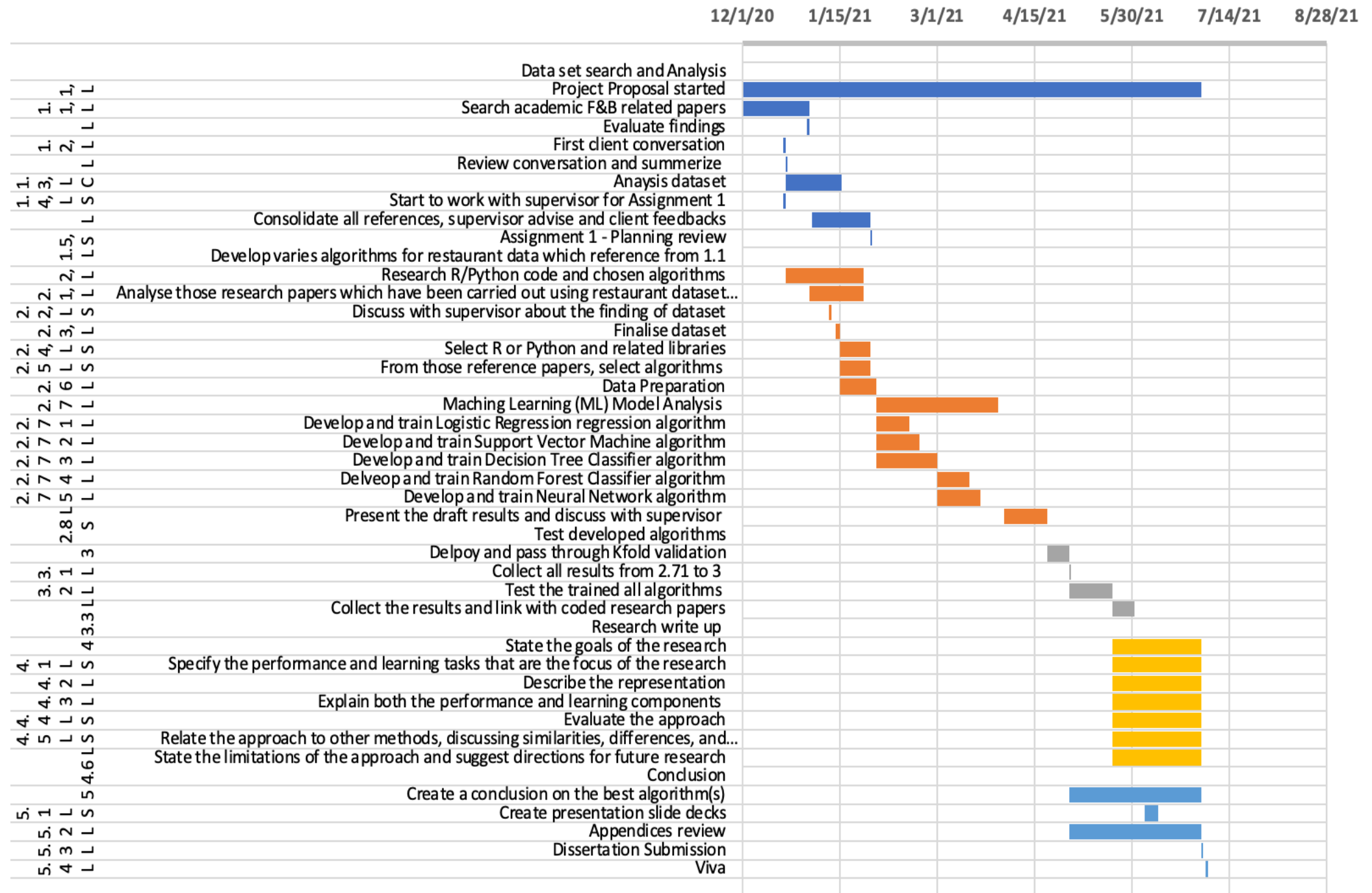
2.1 Forecast and Actual delivery – Diagram & Explanation

The updated project schedule and deliverable – Final Gantt Chart version 2.0



Project Start		12/13/2020		columns used to create the chart									
Task ID with who is Involved	TASK NAME	START	END	HOURS	DELIVERABLE	COLOR	Start	Blue	Red	Green	Brown	Orange	Purple
	Data set search and Analysis												
1, L	Project Proposal started	12/1/20	6/30/21	513.0	Prom02 research	Blue	12/1/20	212	0	0	0	0	0
1.1, L	Search academic F&B related papers	12/1/20	5/25/21	50.0	Select usable papers for reference	Blue	12/1/20	176	0	0	0	0	0
L	Evaluate findings	12/31/20	3/31/21	30.0	Bookmark findings	Blue	12/31/20	91	0	0	0	0	0
1.2, L	First client conversation	12/20/20	12/20/20	0.5	Get the dataset from Client	Blue	12/20/20	1	0	0	0	0	0
L	Review conversation and summerize	12/21/20	12/21/20	3.0	List out the discussion key points	Blue	12/21/20	1	0	0	0	0	0
1.3, L C	Analysis dataset	12/21/20	3/31/21	4.0	Understand all attributes of acquired dataset	Blue	12/21/20	101	0	0	0	0	0
1.4, L S	Start to work with supervisor for Assignment 1	12/20/20	12/20/20	2.5	Prom02 research	Blue	12/20/20	1	0	0	0	0	0
L	Consolidate all references, supervisor advise and client feedbacks	1/2/21	1/28/21	20.0	Prom02 research	Blue	1/2/21	27	0	0	0	0	0
1.5, L	Assignment 1 - Planning review	1/29/21	1/29/21	20.0	Submit Assignment 1 - Planning Review	Blue	1/29/21	1	0	0	0	0	0
	Develop varies algorithms for restaurant data which reference from 1.1												
2, L	Research Python code and chosen algorithms	12/21/20	2/25/21	20.0	Assignment 3- Appendices	Red	12/21/20	0	67	0	0	0	0
2.1, L	Analyse those research papers which have been carried out using restaurant dataset in different algorithms	1/1/21	2/25/21	5.0	Assignment 3- Appendices	Red	1/1/21	0	56	0	0	0	0
2.2, L S	Discuss with supervisor about the finding of dataset	1/10/21	1/10/21	1.0	Getting dataset ready	Red	1/10/21	0	1	0	0	0	0
2.3, L	Finalise dataset	1/13/21	3/20/21	5.0	dataset ready	Red	1/13/21	0	67	0	0	0	0
2.4, L	Select Python and related libraries	1/15/21	2/28/21	8.0	Confirm R or Python	Red	1/15/21	0	45	0	0	0	0
2.5 L	From those reference papers, select algorithms	1/15/21	4/28/21	8.0	Confirm number of ML algorithms to be used	Red	1/15/21	0	104	0	0	0	0
2.6 L	Data Preparation	1/15/21	4/30/21	15.0	Cleaned dataset ready	Red	1/15/21	0	106	0	0	0	0
2.7 L	Machine Learning (ML) Model Analysis	2/1/21	3/28/21	20.0	Select usable ML algorithms	Red	2/1/21	0	56	0	0	0	0
2.71 L	Develop and train Logistic Regression regression algorithm	2/1/21	2/15/21	5.0	Select usable ML algorithms	Red	2/1/21	0	15	0	0	0	0
2.72 L	Develop and train Support Vector Machine algorithm	2/1/21	2/20/21	8.0	Select usable ML algorithms	Red	2/1/21	0	20	0	0	0	0
2.73 L	Develop and train Decision Tree Classifier algorithm	2/1/21	2/28/21	8.0	Select usable ML algorithms	Red	2/1/21	0	28	0	0	0	0
2.74 L	Delveop and train Random Forest Classifier algorithm	3/1/21	3/15/21	8.0	Select usable ML algorithms	Red	3/1/21	0	15	0	0	0	0
2.75 L	Develop and train Neural Network algorithm	3/1/21	3/20/21	10.0	Select usable ML algorithms	Red	3/1/21	0	20	0	0	0	0
2.8 L	Present the draft results	5/1/21	5/20/21	30.0	Find the best model, lowest error from algorithms	Red	5/1/21	0	20	0	0	0	0
	Test developed algorithms												
3	Delpoy and pass through Kfold validation	4/21/21	5/30/21	15.0	Confirm the best model	Green	4/21/21	0	0	40	0	0	0
3.1 L	Collect all results from 2.71 to 3	5/1/21	5/20/21	1.0	Analysis the results	Green	5/1/21	0	0	20	0	0	0
3.2 L	Test the trained all algorithms	5/1/21	5/20/21	5.0	Analysis the results	Green	5/1/21	0	0	20	0	0	0
3.3 L	Collect the results and link with coded research papers	5/21/21	5/30/21	20.0	Analysis the results	Green	5/21/21	0	0	10	0	0	0
4	Research write up												
	State the goals of the research	5/21/21	6/15/21	20.0	Dissertation	Brown	5/21/21	0	0	0	26	0	0
4.1 L	Specify the performance and learning tasks that are the focus of the research	5/21/21	6/15/21	20.0	Dissertation	Brown	5/21/21	0	0	0	26	0	0
4.2 L	Describe the representation	5/21/21	6/15/21	20.0	Dissertation	Brown	5/21/21	0	0	0	26	0	0
4.3 L S	Discuss with supervisor	5/21/21	5/21/21	1.0	Dissertation	Brown	5/21/21	0	0	0	1	0	0
4.4 L	Explain both the performance and learning components	5/21/21	6/1/21	20.0	Dissertation	Brown	5/21/21	0	0	0	12	0	0
4.5 L	Evaluate the approach	5/21/21	6/1/21	20.0	Dissertation	Brown	5/21/21	0	0	0	12	0	0
4.6 L	Relate the approach to other methods, discussing similarities, differences, and advances over previous research	5/21/21	6/15/21	20.0	Dissertation	Brown	5/21/21	0	0	0	26	0	0
4.7 L	State the limitations of the approach and suggest directions for future research	5/21/21	6/1/21	20.0	Dissertation	Brown	5/21/21	0	0	0	12	0	0
	Conclusion												
5	Create a conclusion on the best algorithm(s)	5/1/21	6/15/21	20.0	Dissertation	Orange	5/1/21	0	0	0	0	46	0
5.1 L	Create presentation slide decks	6/5/21	6/10/21	10.0	Viva	Orange	6/5/21	0	0	0	0	6	0
5.2 L	Appendices review	5/1/21	6/10/21	10.0	Dissertation	Orange	5/1/21	0	0	0	0	41	0
5.3 L	Dissertation Submission	7/1/21	7/1/21	5.0	Dissertation	Orange	7/1/21	0	0	0	0	1	0
5.4 L	Viva and Appendices Submission	7/3/21	7/3/21	5.0	Viva and Appendices	Orange	7/3/21	0	0	0	0	1	0
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Original project planning schedule and deliverable – Gantt Chart version 1.0



Project Start		12/13/2020		columns used to create the chart									
Task ID with who is involved	TASK NAME	START	END	HOURS	DELIVERABLE	COLOR	Start	Blue	Red	Green	Brown	Orange	Purple
	Data set search and Analysis												
1, L	Project Proposal started	12/1/20	6/30/21	512.0	Prom02 research	Blue	12/1/20	212	0	0	0	0	0
1.1, L	Search academic F&B related papers	12/1/20	12/31/20	50.0	Select usable papers for reference	Blue	12/1/20	31	0	0	0	0	0
L	Evaluate findings	12/31/20	12/31/20	30.0	Bookmark findings	Blue	12/31/20	1	0	0	0	0	0
1.2, L	First client conversation	12/20/20	12/20/20	0.5	Get the dataset from Client	Blue	12/20/20	1	0	0	0	0	0
L	Review conversation and summerize	12/21/20	12/21/20	3.0	List out the discussion key points	Blue	12/21/20	1	0	0	0	0	0
1.3, L C	Anaysis dataset	12/21/20	1/15/21	4.0	Understand all attributes of acquired dataset	Blue	12/21/20	26	0	0	0	0	0
1.4, L S	Start to work with supervisor for Assignment 1	12/20/20	12/20/20	2.5	Prom02 research	Blue	12/20/20	1	0	0	0	0	0
L	Consolidate all references, supervisor advise and client feedbacks	1/2/21	1/28/21	20.0	Prom02 research	Blue	1/2/21	27	0	0	0	0	0
1.5, L	Assignment 1 - Planning review	1/29/21	1/29/21	20.0	Submit Assignment 1 - Planning Review	Blue	1/29/21	1	0	0	0	0	0
	Develop varies algorithms for restaurant data which reference from 1.1												
2, L	Research R/Python code and chosen algorithms	12/21/20	1/25/21	20.0	Assignment 3- Appendices	Red	12/21/20	0	36	0	0	0	0
2.1, L	Analyse those research papers which have been carried out using restaurant dataset in different algorithms	1/1/21	1/25/21	5.0	Assignment 3- Appendices	Red	1/1/21	0	25	0	0	0	0
2.2, L S	Discuss with supervisor about the finding of dataset	1/10/21	1/10/21	1.0	Getting dataset ready	Red	1/10/21	0	1	0	0	0	0
2.3, L	Finalise dataset	1/13/21	1/14/21	5.0	dataset ready	Red	1/13/21	0	2	0	0	0	0
2.4, L	Select R or Python and related libraries	1/15/21	1/28/21	8.0	Confirm R or Python	Red	1/15/21	0	14	0	0	0	0
2.5 L	From those reference papers, select algorithms	1/15/21	1/28/21	8.0	Confirm number of ML algorithms to be used	Red	1/15/21	0	14	0	0	0	0
2.6 L	Data Preparation	1/15/21	1/31/21	15.0	Cleaned dataset ready	Red	1/15/21	0	17	0	0	0	0
2.7 L	Maching Learning (ML) Model Analysis	2/1/21	3/28/21	20.0	Select usable ML algorithms	Red	2/1/21	0	56	0	0	0	0
2.71 L	Develop and train Logistic Regression regression algorithm	2/1/21	2/15/21	5.0	Select usable ML algorithms	Red	2/1/21	0	15	0	0	0	0
2.72 L	Develop and train Support Vector Machine algorithm	2/1/21	2/20/21	8.0	Select usable ML algorithms	Red	2/1/21	0	20	0	0	0	0
2.73 L	Develop and train Decision Tree Classifier algorithm	2/1/21	2/28/21	8.0	Select usable ML algorithms	Red	2/1/21	0	28	0	0	0	0
2.74 L	Delveop and train Random Forest Classifier algorithm	3/1/21	3/15/21	8.0	Select usable ML algorithms	Red	3/1/21	0	15	0	0	0	0
2.75 L	Develop and train Neural Network algorithm	3/1/21	3/20/21	10.0	Select usable ML algorithms	Red	3/1/21	0	20	0	0	0	0
2.8 L	Present the draft results	4/1/21	4/20/21	30.0	Find the best model, lowest error from algorithms	Red	4/1/21	0	20	0	0	0	0
	Test developed algorithms												
3	Delpoy and pass through Kfold validation	4/21/21	4/30/21	15.0	Confirm the best model	Green	4/21/21	0	0	10	0	0	0
3.1 L	Collect all results from 2.71 to 3	5/1/21	5/1/21	1.0	Analysis the results	Green	5/1/21	0	0	1	0	0	0
3.2 L	Test the trained all algorithms	5/1/21	5/20/21	5.0	Analysis the results	Green	5/1/21	0	0	20	0	0	0
3.3 L	Collect the results and link with coded research papers	5/21/21	5/30/21	20.0	Analysis the results	Green	5/21/21	0	0	10	0	0	0
4	Research write up												
4	State the goals of the research	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
4.1 L	Specify the performance and learning tasks that are the focus of the research	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
4.2 L	Describe the representation	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
4.3 L	Explain both the performance and learning components	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
4.4 L	Evaluate the approach	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
4.5 L	Relate the approach to other methods, discussing similarities, differences, and advances over previous research	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
4.6 L	State the limitations of the approach and suggest directions for future research	5/21/21	6/30/21	20.0	Assignment 3	Brown	5/21/21	0	0	0	41	0	0
	Conclusion												
5	Create a conclusion on the best algorithm(s)	5/1/21	6/30/21	20.0	Assignment 3	Orange	5/1/21	0	0	0	0	61	0
5.1 L	Create presentation slide decks	6/5/21	6/10/21	10.0	Assignment 3	Orange	6/5/21	0	0	0	0	6	0
5.2 L	Appendices review	5/1/21	6/30/21	10.0	Assignment 3	Orange	5/1/21	0	0	0	0	61	0
5.3 L	Dissertation Submission	7/1/21	7/1/21	5.0	Assignment 3	Orange	7/1/21	0	0	0	0	1	0
5.4 L	Viva	7/3/21	7/3/21	5.0	Assignment 3	Orange	7/3/21	0	0	0	0	1	0
		Insert new rows above this one											

According to above Gantt chart v2 vs v1, there are some major different from original planning to the actual work: -

1. The real time spent searching for a reference academic article was far longer than anticipated.
2. Data reduction and data transformation during data cleansing consume more than 60% of the total planning time.
3. Deployment of the test and training sets from Python also necessitates a significant amount of adjustment between dataset and Python code modifications. It also took significantly longer than intended.

2.2 Project Management Methods, Techniques and Tools

Method / Technique / Tool	Use & Rationale	Appropriateness	Evidence
Agile project method, MS excel or Trello is the project management tool that helps to accomplish the research	Machine learning project could use an agile approach, it is useful to take a step back and define the key concepts that should drive a lean agile machine learning project.	1.Roles – research owner, process expert, data owner etc.. 2.Eventsv - daily or weekly reviews 3.Process to create and prioritize items – items/tasks are created, prioritized and viewed on task board in Trello.	Larson and Chang, 2016
Data driven scrum (DDS), tool is scrum Kanban, DDS guide	DDS helps to ensure that me and the Ambros can achieve some key achievements	1.Functional iterations 2. Flexible task estimation. 3. Iteration independent meeting 4.Collective analysis	Wei and Rana, 2019

3. Evidence

Section 1 Evidence	Section 2 Evidence	Section 3 Evidence
Brown and Mitchell, 1993 Ayyadevara, 2018 Kim and Gu, 2006	L'heureux et al., 2017	Larson and Chang, 2016
Tanizaki et al., 2019 Lasek et al., 2016a	Kim and Gu, 2006	Wei and Rana, 2019
Mathur, 2018, Lian et al., 2017b, Lian et al., 2017a,	Mathur, 2018	

Presentation Slides:-

<https://github.com/nunufung/PROM02/blob/main/Prom02%20ppt%20v1.46.pdf>

Python code in github

<https://github.com/nunufung/PROM02/blob/main/Restaurant Sales and Status Predictions v5.ipynb>

Dataset CSV in github

https://github.com/nunufung/PROM02/blob/main/dataset%20v7_57k%20another%20pattern%203.csv

Books and reference in github

<https://github.com/nunufung/PROM02>

4. References

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