[2025] Machine Learning Projects – Milestone 2

The objective of the projects is to prepare you to apply different machine learning algorithms to real-world tasks. This will help you to increase your knowledge about the workflow of the machine learning tasks. You will learn how to apply pre-processing, feature engineering, regression, and classification methods.

- **Delivering Milestone 2: Practical exam.**

- You must deliver a detailed report for milestone 2 contains all your work in this phase. Combine both reports and deliver a complete report for the project (Hardcopy).

- Each team should work on their project's updated dataset for milestone 2.

- **In the practical exam**:

  - We will give you two unseen test sets, **one for regression and one for classification.**

  - Make sure you **save your trained model** and create a test script that takes the new csv file, **loads the saved models,** and outputs predictions. This is to allow us to test your model without re-training.

    Hint 1: You can use libraries such as 'pickle' to save and load your models.
    Hint 2: Any model that you need to 'fit' or 'learn' during training means you need to save it and reload it for the test to work correctly.

  - You should be able to handle missing values for features in a test sample. (You can't drop an entire test sample row).

- You must Show the MSE and R2 score of the regression models and the classification accuracy of each classifier on the test set.

- Each team member will be graded individually according to their response to the oral questions related to their project.

➢ In the second milestone, you will apply the following: -

Classification:

- Split your dataset into 80% training and 20% testing.

- Train at least 3 different models to classify each sample into distinct classes.

- Choose at least two hyperparameters to vary. Study **at least three different choices** for each hyperparameter. When varying one hyperparameter, all the other hyperparameters should be fixed.

- [**Extra Requirement Mandatory for Teams of 6 Only**]: Apply (heteregenous) ensemble learning using different machine learning models to get the output. You should try both voting and stacking approaches.

(Note: Ensemble methods based on the same base model e.g. random forest will not be counted as doing the extra task)

Milestone 2:

➢ Classification and Hyperparameter tuning.

Milestone 2 Report Must Include:

❖ Summarize the **classification accuracy**, **total training time**, and **total test time** using three bar graphs.

- Note that your **Feature Selection** process may differ in this phase (classification) than the previous (regression), If so, explain your feature selection process and how it was proved or disproved.

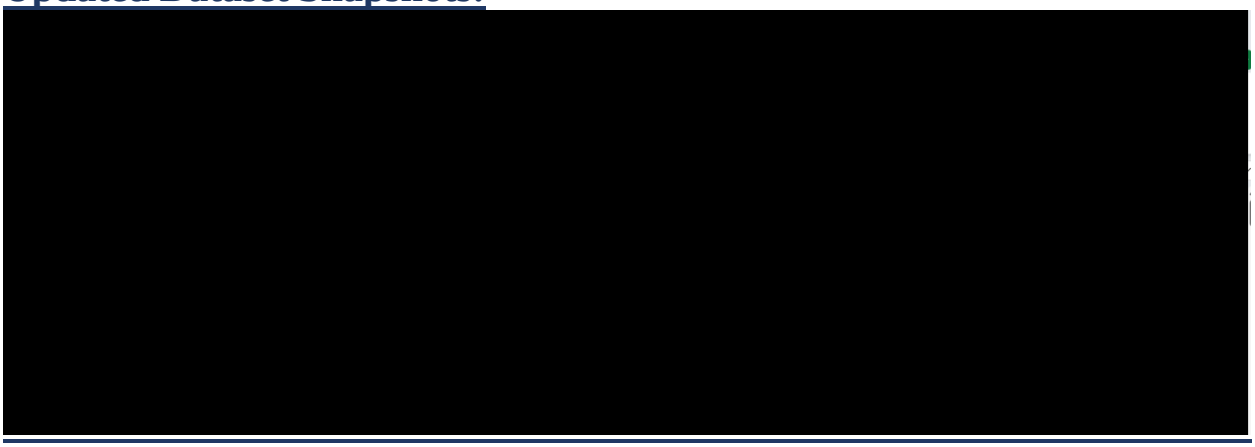
- Explain in details how **hyperparameter tuning** affected your models' performance.

- Finally, write a **conclusion** about this phase of the project and what intuition you had about your problem and how it was proved/disproved.

Project (1): Tech Companies Acquisition Price Prediction

An **updated dataset** will be provided for each project in the second milestone.

Updated Dataset Snapshots:



Updated Dataset Description:

- The **"**price**"** column used in the previous milestone as the actual output has been removed.

- A New **"Deal size class"** column has been added instead. Each acquisition can have a category of {Small, Medium or Large}.

Milestone 2 Classification task:

Classify each acquisition into one of three categories{Small, Medium or Large} using **the updated dataset.**

Project(2): Guest Satisfaction Prediction

An **updated dataset** will be provided for each project in the second milestone.

Updated Dataset Snapshot:

minimum_	maximum_	number_of	number_of	first_review	last_review	guest_satisfaction	requires_li	instant_bo	is_busines	cancellati
5	1125	1	2	11/17/2017	11/17/2017	Average	f	f	f	strict_14_
4	15	13	26	8/2/2013	7/31/2019	High	f	f	f	moderate
1	1125	85	170	7/23/2017	7/16/2019	Very High	f	f	f	strict_14_
2	1125	106	212	5/1/2018	8/3/2019	Very High	f	t	f	moderate
2	1125	1	2	6/30/2019	6/30/2019	Very High	f	t	f	strict_14_
3	1125	102	204	4/18/2015	8/14/2019	High	f	f	f	moderate
2	1125	8	16	12/18/2016	7/25/2019	Very High	f	f	f	strict_14_
4	1125	2	4	8/4/2018	7/30/2019	Very High	f	t	f	strict_14_
1	1125	94	188	7/13/2018	8/12/2019	Average	f	f	f	moderate
4	5	1	2	7/20/2017	7/20/2017	Average	f	t	f	moderate
2	7	173	346	10/2/2017	7/30/2019	High	f	t	f	moderate
30	90	57	114	5/25/2016	8/2/2019	Average	f	f	f	moderate
2	1125	4	8	2/21/2018	1/27/2019	Average	f	t	f	strict

Updated Dataset Description:

- The **"review_score_rating"** column used in the previous milestone as the actual output has been removed.

- A New column is added **"guest_satisfaction"**. **guest_satisfaction** can have a category of {Average, High or Very High}.

Milestone 2 Classification task:

Classify guest satisfaction into one of three categories: {Average, High or Very High} using **the updated dataset.**

Project(3): Parkinson's Disease Prediction

An **updated dataset** will be provided for each project in the second milestone.

Updated Dataset Snapshot:

Cholester	Cholester	UPDRS	MoCA	Functional	DoctorInC	WeeklyPh	MedicalHisto	Symptoms	Diagnosis
25.542044	237.29080	4.1616200	28.626479	5.3550554	DrXXXCon	4:14	{'FamilyHisto	{'Tremor': 'No', 'Ri	0
23.0981	150.13	176.22040	20.310768	9.9279976	DrXXXCon	0:59	{'FamilyHisto	{'Tremor': 'No', 'Ri	0
66.076196	66.871416	133.281	20.614059	5.7043076	DrXXXCon	5:38	{'FamilyHisto	{'Tremor': 'Yes', 'F	1
41.725854	248.16348	155.95202	4.2376960	7.2504347	DrXXXCon	5:02	{'FamilyHisto	{'Tremor': 'No', 'Ri	1
23.251948	127.74769	49.523001	21.475758	6.1191300	DrXXXCon	0:08	{'FamilyHisto	{'Tremor': 'No', 'Ri	0
71.763342	88.026496	82.731035	25.411267	9.7364274	DrXXXCon	1:53	{'FamilyHisto	{'Tremor': 'Yes', 'F	1
99.203744	314.08643	36.223156	28.442607	8.7604145	DrXXXCon	1:53	{'FamilyHisto	{'Tremor': 'No', 'Ri	0
42.278671	322.18642	120.20836	6.8956536	0.8634021	DrXXXCon	2:10	{'FamilyHisto	{'Tremor': 'Yes', 'F	1
92.713900	127.16783	122.03778	23.416523	9.33717	DrXXXCon	0:18	{'FamilyHisto	{'Tremor': 'No', 'Ri	1
90.350296	359.08665	121.55887	26.580741	5.9778049	DrXXXCon	8:48	{'FamilyHisto	{'Tremor': 'No', 'Ri	0
90.496007	88.871618	149.53111	8.6615604	3.8288200	DrXXXCon	6:29	{'FamilyHisto	{'Tremor': 'Yes', 'F	1

Updated Dataset Description:

- A New column is added **"Diagnosis"**. **Diagnosis** can be one of two values {0 or 1} referring to Yes or No.

Milestone 2 Classification task:

Classify diagnosis into one of two categories: {0 or 1} using **the updated dataset.**

Project(4): Videogame Sales on Steam Prediction

An **updated dataset** will be provided for each project in the second milestone.

Updated Dataset Snapshot:

steamId	price	copiesSold	publisherClass	reviewScore	aiContent
730	0	Platinum	AAA	87	
570	0	Platinum	AAA	82	
578080	0	Platinum	AAA	59	
440	0	Platinum	AAA	90	
1172470	0	Platinum	AAA	67	
550	9.99	Platinum	AAA	98	
304930	0	Platinum	Indie	91	
1782210	0	Platinum	Hobbyist	92	
230410	0	Platinum	AAA	88	
218620	9.99	Platinum	AA	90	

Updated Dataset Description:

- The "copiesSold" column values represents categories. copiesSold category can be one of four values {Gold, Silver, Platinum and Bronze}.

Milestone 2 Classification task:

Classify game app category to be one of four values {Gold, Silver, Platinum and Bronze} using **the updated dataset.**

Project(5): Videogame Review Score on Steam Prediction

An **updated dataset** will be provided for each project in the second milestone.

Updated Dataset Snapshot:

steamId	price	copiesSold	publisherC	reviewScore	aiContent
730	0	302158048	AAA	Very Positive	
570	0	212896574	AAA	Very Positive	
578080	0	161971233	AAA	Mixed	
440	0	99060457	AAA	Very Positive	
1172470	0	67554185	AAA	Mixed	
550	9.99	63975495	AAA	Overwhelmingly Positive	
304930	0	59633334	Indie	Very Positive	
1782210	0	54807548	Hobbyist	Very Positive	
230410	0	52803785	AAA	Very Positive	

Updated Dataset Description:

- The "reviewScore" column values represents categories such as {VeryPositive, Mixed, Negative and more}. There are nine categories in total.

Milestone 2 Classification task:

Classify each sample into one of the nine categories using **the updated dataset.**