

## **Reflection and E-Portfolio Report for Machine Learning Module**

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**Module:** Machine Learning

**GitHub Repository URL:** <https://salehalmarzooqi.github.io/E-portfolio/machine-learning.html>

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# Reflection

## 1. Introduction

The Machine Learning module has been an essential aspect of my life as a student. It helped me acquire practical information regarding the realm of machine learning algorithms, data analytics, and their application in practice. When working on the module, I was required to calculate the technical and general ethical and social consequences of machine learning systems. This is a reflection based on the method applied by Rolfe et al. (2001), which provided a summary of my experiences, learning, and development throughout the module.

## 2. WHAT? (Description of Experience)

Early in the module, I was presented with the fundamentals of machine learning, which includes the step of data preprocessing, at which I learned that Exploratory Data Analysis (EDA) was an important concept to me in learning the data initially, followed by the algorithms as emphasized by Dhummad, (2025). Unit 4 is another unit that I found the most interesting because we employed Scikit-Learn to make predictive models through the use of linear regression. Another feeling of accomplishment I experienced was the opportunity to transfer the theory to the practical reality and apply Python to form the regression models and test their efficiency.

Besides this, another important part of my experience was when we worked on a team project in Unit 6, where we were instructed on clustering algorithms such as the K-means clustering. I was able to introduce the clustering algorithms in Python, analyse the data, and prepare it to be

analysed. It was a practical implementation of what we had learned, and it enabled me to relate directly theoretical knowledge and practical consequences.

Learning about the complexities of neural networks and how backpropagation of training models works was the greatest challenge of the module. Nevertheless, with the examples and the discussions on peers, I was capable of understanding the key points, particularly in Units 7 and 8, where we studied the concept of an artificial neural network (ANN) and its development through the adaptation of the weights according to the prediction error.

### **3. SO WHAT? (Emotional Response and Analysis)**

I was initially somewhat confused by the machine learning algorithms, especially the deep learning methods such as ANN and the convolutional neural network (CNN) as mentioned by Singh, and Sabrol, (2021). Sometimes I felt that I could not grasp such sophisticated ideas, but with practice and support, I managed to gain confidence. As an example, when I was doing the team project, I had an issue with the output of the clustering algorithm, and I was initially frustrated with it. However, my troubleshooting abilities, consultation with other team members and solution iteration added some measure of achievement.

The module led to frustration and gratification on the emotional level. Learning curve was steep as well, but at some point, I experienced pleasure at the algorithms working correctly. Practical experience in machine learning and work with actual data gave me more motivation due to the immediate impact that machine learning can make on industries. However, at the same time, I was thinking about the ethical component of machine learning, which includes the fact that such data and models can be biased. The discussions in Unit 12 concerning the issue of algorithmic fairness

were insightful, and I realised the necessity to ensure that machine learning regimes are both developed and deployed responsibly.

#### **4. NOW WHAT? (Learning and Changed Actions)**

Looking back at my experience as a learner, I realise that I should not only develop certain technical skills, but also consider the overall impact of machine learning on society. I will also be more skeptic about machine learning projects in the future based not only on how accurate the model itself is, but also on the ethical character of the data it was provided with. I will further explore more into data bias and fairness to ensure that the systems that I will be developing will assist in fairly accommodating the different populations.

The second lesson was the group-like nature of the team project. I learned the significance of communication, especially in the virtual world as emphasized by AlGerafi, Mohammed AM, et al. (2023). Communication of ideas and the fact that I attended group meetings also played a significant role in the success of the project. In my next work with others, I will ensure that there is a clear definition of the roles and regular updates are made to ensure the project is on track.

The module has enhanced my problem-solving skills personally. I am now more confident that I will be able to utilise machine learning algorithms to handle complex data sets and make the trade-offs. Exploratory data analysis will be among the first steps that I will apply in future projects to have a good understanding of the data set before applying any machine learning models.

#### **5. Conclusion**

In conclusion, the Machine Learning module has been a highly enlightening and revolutionary experience. It pushed me out of my comfort zone and applied technical knowledge in practice, and I critically reflected on the ethical implications of machine learning. I also learned many valuable experiences in the form of machine learning algorithms, regression and neural networks. I also trained to work collaboratively in group projects, and that is what made me a team player (technically). My current ability to be more even-handed in my approach to technical competence and moral responsibility better equips me to tackle the problems of machine learning in the future.

### **References:**

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- Dhummad, S., 2025. The Imperative of Exploratory Data Analysis in Machine Learning. *Scholars Journal of Engineering and Technology*, 13.
- Singh, N. and Sabrol, H., 2021. Convolutional neural networks-an extensive arena of deep learning. A comprehensive study. *Archives of Computational Methods in Engineering*, 28(7), pp.4755-4780.

# E-Portfolio

## 1. Introduction

The Machine Learning module has proven to be an experience that has changed my worldview to an opening, and this enabled me not just to gain technical knowledge but also a sensitive feeling of what the concept of machine learning would entail, both technically and within the social context. I was also introduced to a very diverse set of machine learning algorithms and approaches, starting with the simple linear regression and moving to the more complicated ones, e.g., clustering algorithms, artificial neural networks (ANNs), and convolutional neural networks (CNNs). This module has equipped me with a set of practical skills to apply machine learning models, but it has also allowed me to think critically about the ethical issues of applying these models.

This e-portfolio will help present the contribution to the teamwork and individual assignments and demonstrate the process of my development throughout the module. I will consider my learning experiences, the problems I encountered, the way I have solved the dilemmas, and the skills that I acquired. Also, I will review the ethical implications of the application of machine learning technologies and ways in which I can apply these lessons to my future in working with machine learning as a practitioner.

## 2. Project Outcomes and Contributions

The team project on Unit 6 was one of the most valuable learning moments in my life, as we used K-means clustering on a set of data. My main task was to apply a clustering algorithm to Python and to analyse the findings and **work of** Wu, (2021) was helpful in this regard. This practical

assignment allowed me to learn about the details of the clustering process, i.e., the process of collecting similar data points, basing them on certain attributes. I was also involved in the process of cluster output analysis, where the consistency of the results and their readability according to the dataset that we worked with had to be ensured.

The actual problem of this unit was the ability to comprehend how the number of clusters can impact the output, and to make sure that the algorithm was not overfitting or underfitting. I could also perform trial and error on the model, where I made the Silhouette Score, Davies-Bouldin Index and Elbow Method to gauge the performance of the model as studied by Hartama, and Oktaviani, (2025). It turned out to be a priceless experience since I was able to apply the theory to real data and to continue being amused at the idea of clustering algorithms and their application.

Unit 11, as a team, utilised the model selection and evaluation in Unit 11 as the required stage to ensure that machine learning models are of high quality. Another activity I also engaged in was hyperparameter tuning, and this entailed optimising the model parameters to improve the performance of the model. I had practical experience in model optimisation when I optimised models by varying learning rates, batch sizes, and activation functions. I also assisted in the comparisons of the models to different measures that include precision, recall, F1 score, and AUC-ROC. This unit indicated how critical it is to evaluate the performance of the model not only in terms of accuracy, but also scalability, reliability, and applicability of the model to the real world.

I made regular additions to my e-portfolio throughout the module with my work on the team project, such as snippets of code, analysis processes, visualisations, and performance assessments.

I also used to keep a record of my input into the discussions and peer and tutor feedback, which contributed to my monitoring of my progress and honing my knowledge of the topics.

### **3. Analysis of Data and Collaborative Discussions**

The group conversations formed a crucial aspect of my learning. These and other discussions within the team and the rest of the wider classes enabled me to approach the material critically and expand my knowledge as to what machine learning entails. During the first several weeks, I was listening to talks about the topic of supervised and unsupervised learning, during which diverse machine learning algorithms may be applied to address real-life problems.

One of the most significant discussions was Unit 6 because we were introduced to the ethical component of machine learning in highly sensitive areas, such as health and the criminal justice field. I explained my thinking about discriminatory results caused by biased datasets, using such examples as predictive policing and discriminative hiring algorithms. This discussion gave rise to an even larger discussion on the role of data scientists and machine learning practitioners in ensuring fairness, transparency, and accountability in their practice as researched by Boppiniti, (2023). It was an excellent reminder of the fact that it is very easy to ignore how significant it is to be mindful of the data with which we train models, or what the impact of algorithmic bias can be.

In Unit 9, when the topic of computer vision and CNNs was discussed, I actively attended the lessons on the examination of the ethical issues related to the deepfake technology and its abuse in generating false content. This made me think about the dual-purpose nature of AI technologies; the same algorithms may be applied to a good purpose and a bad purpose. The ethical awareness aspect of machine learning has become relevant to me, as I have come to understand that, as a



future employee in this sphere, I should always be aware of the overall impact that the work I will perform has on society.

#### **4. Reflections on Machine Learning**

This module has been the most insightful in the sense that I have understood that machine learning is more than generating algorithms, but also making sure that such systems are ethically responsible. In Unit 12, we discussed Industry 4.0, which is the industry that is being transformed by AI and machine learning, including the healthcare, finance, and manufacturing industries. This made me realise the extent to which machine learning has been integrated into the future of industries and everyday life.

At the beginning of the module, I primarily focused on the technical aspect of machine learning, i.e. the process of making models and getting to know more about the algorithms behind them. Nonetheless, over the course of the module, I gained awareness of the ethical issues of machine learning practitioners. The readings on the data bias, algorithmic fairness, and transparency made me even more convinced of what I can do to make sure that the machine learning models that I will develop will be inclusive and fair. I will get to understand more about these ethical challenges, especially their resolution concerning AI management and policymaking in the future.

The other important lesson learned was that of teamwork and collaboration. Being a team project, I got to know how to work efficiently in a virtual team setting, organise tasks, update colleagues on the progress, and give them feedback. Such experiences have improved my communication skills and prepared me for another related project in the future, which requires collaboration. I have

learned how effective communication and respecting each other can make a project a success, and in this case, when it comes to working remotely.

## 5. Evidence of Skills and Knowledge Development

The multiple module units have enabled me to acquire a wide range of skills, including technical and interpersonal. Among the important skills I have developed during the course, there are:

- **Machine Learning Algorithms:** I acquired practice in supervised and unsupervised methods of learning, such as linear regression, K-means clustering, and artificial neural networks. I used these methods in the real world, where I learned how they are real-world applicable and what their shortcomings are.
- **Programming Skills:** I developed knowledge in working with Python to complete machine learning tasks, such as operating Pandas to manipulate data, Scikit-learn to create models, and TensorFlow to work with deep learning. I also educated myself on how to use GitHub to manage version control and collaborate with other team members to make sure my code is well-structured and can be accessed by others.
- **Ethical Awareness:** Class discussions and reflective practices have enabled me to have an in-depth insight into the ethical issues in machine learning professionals. I have researched the issues of data privacy, bias in algorithms, and accountability, and they have affected my attitude toward machine learning projects.
- **Team Work Skills:** My teamwork skills have enabled me to enhance my teamwork, problem-solving solving and project management skills as I worked on several projects with the team. I got to know the experience of collaborating to solve complicated issues in

a group, and how to organise the work of the group and control group dynamics, applying such tools as Trello.

## 6. Conclusion

This e-portfolio is a reflection of my learning and development during the Machine Learning module. I have acquired technical skills as well as ethical skills through individual assignments, group projects, and critical thinking. I have now understood more about machine learning functioning, model development, and how to ensure that the models are fair, transparent, and correspond to the professional and ethical standards.

In the future, my skills in machine learning will be further developed, specifically in the fields of neural networks, deep learning, and the development of ethical AI. I am better informed about the role that comes with the practice of machine learning and eager to implement these lessons in the future. My future career in the fast-paced machine learning sector will be based on the knowledge and skills I have acquired during the current module.

## References:

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- Hartama, D. and Oktaviani, S., 2025. OPTIMIZATION OF K-MEANS AND K-MEDOIDS CLUSTERING USING DBI SILHOUETTE ELBOW ON STUDENT DATA. *JURTEKSI (Jurnal Teknologi dan Sistem Informasi)*, 11(2), pp.289-296.

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## Appendix:

### SWOT matrix:

Strengths	Weaknesses
1. <b>Technical Expertise:</b> Developed a strong foundation in machine learning algorithms, including linear regression, K-means clustering, and neural networks (ANN & CNN).	1. <b>Challenging Concepts:</b> Initially struggled with deep learning algorithms (e.g., CNNs) and complex concepts like backpropagation.
2. <b>Practical Application:</b> Gained hands-on experience in Python for machine learning tasks and developed real-world models using Scikit-learn and TensorFlow.	2. <b>Time Management:</b> Balancing theory, coding exercises, and group projects was challenging, especially with the steep learning curve.
3. <b>Team Collaboration:</b> Gained experience in collaborative work, using tools like GitHub, Trello, and Slack to manage group projects.	3. <b>Limited Exposure to Advanced Machine Learning:</b> Limited experience with advanced techniques like reinforcement learning or generative models.
4. <b>Ethical Awareness:</b> Gained a deep understanding of the ethical issues in machine learning, especially related to bias, fairness, and transparency.	4. <b>Superficial Industry Exposure:</b> Limited real-world exposure to machine learning applications in industries beyond case studies.
Opportunities	Threats
1. <b>Further Learning:</b> The opportunity to specialize in deep learning, neural networks, and AI ethics.	1. <b>Rapid Technological Change:</b> The fast pace of advancement in machine learning techniques may make it difficult to stay up-to-date.
2. <b>Industry Demand:</b> Growing demand for machine learning professionals in industries such as healthcare, finance, and manufacturing.	2. <b>Ethical Dilemmas in Deployment:</b> As machine learning models become more integrated into systems, the risk of ethical issues such as bias in decision-making increases.
3. <b>Real-World Applications:</b> The chance to work on more industry-relevant projects, especially in Industry 4.0 environments.	3. <b>AI Regulations:</b> The evolving legal landscape surrounding AI may impact the adoption and deployment of machine learning systems.
4. <b>Research Opportunities:</b> Opportunities to explore cutting-edge topics like reinforcement learning and AI policy-making.	4. <b>Data Privacy Concerns:</b> The increased use of personal data in machine learning models could result in privacy concerns and regulatory challenges.

### My action plan:

Goal	Actions	Timeline	Outcome
<b>1. Improve Deep Learning Skills</b>	Complete courses or tutorials on advanced topics like CNNs, RNNs, and reinforcement learning. Work on Kaggle competitions to gain hands-on experience.	6-12 months	Improved proficiency in implementing complex deep learning models.
<b>2. Enhance Understanding of Ethical AI</b>	Engage in research on AI ethics, particularly regarding fairness, transparency, and accountability. Attend seminars or workshops on responsible AI practices.	3-6 months	Gained expertise in ensuring that machine learning systems adhere to ethical standards in real-world applications.
<b>3. Gain Experience with Advanced Algorithms</b>	Learn advanced machine learning techniques such as generative models and reinforcement learning. Read research papers and implement state-of-the-art algorithms.	6-12 months	Ability to design, implement, and evaluate complex machine learning models using advanced techniques.
<b>4. Strengthen Teamwork and Communication</b>	Continue using GitHub and Trello for project collaboration. Practice active communication and leadership in group settings.	Ongoing	Improved collaboration skills and ability to lead or work effectively in teams.
<b>5. Master Model Evaluation and Optimization</b>	Work on hyperparameter tuning and model selection techniques. Apply model evaluation metrics like F1 score, precision, recall, and AUC-ROC to improve model performance.	3-6 months	Increased competence in optimizing models and selecting the most appropriate models for different tasks.

### Professional skills matrix:

Skill Area	Current Competency Level	Development Actions	Timeline	Target Competency Level
<b>Machine Learning Algorithms</b>	Intermediate	Study advanced algorithms such as reinforcement learning, generative adversarial networks, and advanced neural networks. Participate in machine learning challenges.	6 months	Advanced: Capable of implementing and optimizing advanced ML algorithms independently.
<b>Programming Skills (Python &amp; ML Libraries)</b>	Intermediate	Continue working with TensorFlow and Scikit-learn to gain hands-on experience. Develop more complex Python-based machine learning projects.	Ongoing	Advanced: Proficient in Python and major ML libraries like TensorFlow, Keras, and PyTorch.
<b>Ethical Awareness in AI</b>	Developing	Research more about AI ethics and data governance. Participate in ethical AI workshops or seminars.	3-6 months	Advanced: Able to develop and implement machine learning systems with ethical considerations.
<b>Team Collaboration &amp; Communication</b>	Intermediate	Continue using collaboration tools like GitHub and Trello. Participate in virtual team projects to enhance communication and leadership skills.	Ongoing	Advanced: Excellent team leader and communicator in virtual and real-world projects.
<b>Model Evaluation &amp; Optimization</b>	Intermediate	Regularly work on model evaluation using metrics like F1 score, AUC-ROC, and hyperparameter tuning. Test various evaluation techniques	3-6 months	Advanced: Able to evaluate, optimize, and select the most effective models for a range of tasks.
<b>Critical Thinking &amp; Problem Solving</b>	Developing	Regularly analyze case studies and apply machine learning models. Focus on solving complex machine learning problems with practical applications	Ongoing	Advanced: Able to approach and solve complex ML problems with critical thinking and effective solutions.