UNDERSTANDING ARTIFICIAL INTELLIGENCE, A REPORT REVIEW ON APPLICATION OF INTELLIGENT AGENTS IN AGRICULTURE

ABSTRACT

Agriculture is directly linked to the survival of the human species and is essential for a more robust GDP in every country. The alarming rise in global population creates an unceasing demand for food, and the usual farmers' traditional practices are no longer effective enough to meet this demand. The birth of Artificial Intelligence today has helped in achieving trailblazing improvements in many sectors of the world, especially the Agricultural sector, and this has helped reduce the hassle that is tied to manual farming to the barest minimum. This report states the Aims and contributions that Intelligent Agents design have in Agriculture, a review of successes, challenges and their solutions and a few suggestions for opportunities have been clearly presented.

INTRODUCTION

A major Reason why artificial intelligence has been created is to build machines that can function autonomously with little or no human intervention and of course, help improve performance and make innovative changes overtime in whichever industry or sector it is being applied. In previous times, Agricultural activities were limited to manual tillage of farmlands, manual harvesting of crops and watering of plants, hand picking of weeds and plants infected by diseases, many activities of which consumed a large amount of time and perseverance to achieve of which many farmers end up spending the little profit gained to employ labour all over again. But with the emergence of Artificial Intelligence in agriculture, Intelligent Agents such as: Farmer’s Alexa, Driverless/Smart tractors, Intelligent spraying machines, Crop monitoring systems, Disease diagnosis app, AI- driven weather predicting bot, drones, etc. have being designed to tackle these shortcomings and globally improve the problem of food shortage and decrease the adverse effects that Natural occurrences such as Weather, lack of rainfall, flood etc. have on Agriculture.

METHODOLOGY

For this Report, four (4) Articles have been reviewed on the Aims and Contributions of Intelligent Agents in Agriculture and various Successes that have been recorded have been highlighted together with the various challenges encountered. Subsequently, solutions to these problems have been addressed and some opportunities that can also serve as future contributions have been identified.

AIM(s) AND CONTRIBUTIONS

ARTICLE 1: Aims to make research on Artificial Intelligence and the various ways by which it is relevant to Agriculture, Gauge the processes by which AI can be

incorporated into Agriculture and make contributions on how the various limitations in this sector can be supervised with AI.

Article 2: Aims to project real-world cases in which AI can be applied in Agriculture, while also including its downsides, it makes contributions to how these challenges provide basis for future studies.

Article 3: Aims to give insight on the current state of AI by citing, accomplishments, assessing problems and how AI algorithms can be used realistically.

Article 4: Aims to presents the areas in Agriculture where AI is used and understand how AI powered the Agricultural Industry.

RECORDS OF SUCCESES OF INTELLIGENT AGENTS IN AGRICULTURE

1.**Drones and Robots**: Artificial Intelligence played a direct role in the manufacture of selfdriven machines that has tremendously salvaged Agriculture through Machine Learning, its ability to spray, water, and observe plants and detect diseases while maintaining accuracy and efficiency is a groundbreaking success in Agriculture.

2. Weather Prediction: Weather is crucial to agriculture and AI-driven weather forecasts have been recorded to successfully guess rain hours in advance by evaluating large data conveyed by weather satellite and this has helped Farmers to boost Agricultural outputs.

3.Weed Management: Weeds naturally compete with crops for nutrients and are mostly toxic to humans, AI has been able to detect weeds by using neural networks and image preprocessing to assist farmers destroy them.

4.Soil and Irrigation Monitoring: A soil moisture sensor has been designed to gather data and determine soil temperature and water level without human involvement, this has successfully helped farmers to estimate how much water is required by crops for optimum yield.

CURRENT GAPS or CHALLENGES OF INTELLIGENT AGENTS IN AGRICULTURE

1.Lack of Technical know-how: Majority of farmers in rural areas are ignorant and do not have the knowledge of how AI machines operate, this discourages them from acquiring these technologies even with its benefits.

2.Privacy and Security: A huge threat is placed on a farmers data and since no arm of government oversees AI in agriculture, farmers are prone to cyberattacks.
3.Internet-Based restrictions: For many of these technologies to function, it requires some sort of internet connection which is unavailable in rural areas
4: Big Data: AI systems require large Data to train the Machine to make accurate predictions, and data is challenging to obtain within a limited time.

SOLUTIONS TO THESE CHALLENGES

1: The challenge of internet can be solved by government implementing an online service with AI systems in Agriculture to help farmers cultivate crops effectively irrespective of location

2: Farmers should be enlightened on the AI developments and how it will improve their outputs, and should be encouraged to develop skills that will broaden their knowledge on how to operate the various technologies

CONCLUSION

This report reviewed four journals that aimed at studying the research of AI, its relevance and has given insight to the Application of Intelligent Agents in the Agricultural Industry, it states recorded successes of ways Artificial Intelligence has improved Weather forecasts, Weed management, Irrigation, Detection of diseases, etc. Challenges encountered has been discusses and possible solutions to them are duly outlined with an insight of possible future contributions and it can be derived that Artificial Intelligence will be a major contribution is solving global challenges relating to Agriculture and can help sustain the economy of every country by improving food supply.

List of Reviewed Articles

Hossen, M.I., Fahad, N., Sarkar, M.R. and Rabbi, M.R. (2023). Artificial Intelligence in Agriculture: A Systematic Literature Review. *Turkish Journal of Computer and Mathematics Education (TURCOMAT)*, [online] 14(1), pp.137–146. Available at: https://turcomat.org/index.php/turkbilmat/article/view/13384/9625 [Accessed 4 May 2023].

Javaid, M., Haleem, A., Khan, I.H. and Suman, R. (2022). Understanding the potential applications of Artificial Intelligence in Agriculture Sector. *Advanced Agrochem*, [online] 2(1). doi:https://doi.org/10.1016/j.aac.2022.10.001.

Neha, Gupta, P., Nadeem, D., Abuzar and Elahi, A. (2023). *Artificial Intelligence in Agriculture*. [online] papers.ssrn.com. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4345592 [Accessed 4 May 2023].

www.google.com. (n.d.). *artificial intelligence in agriculture jornal of physics - Google Search*. [online] Available at: https://www.google.com/search?q=artificial+intelligence+in+agriculture+jornal+of+physics&oq=artificial+intelligence+in+agriculture+jornal+of+physics&aqs=chrome..69i57j33i10i160l2.21079j0j15&sourceid=chrome&ie=UTF-8 [Accessed 4 May 2023].

COMPONENT TWO (Sales Performance of Video Games)

Abstract

From the given Dataset, this report predicts the sales performance of video game dataset globally, clusters and classifies them based on different categorical variables. An insight on the combination of which variables used to best predict global sales is presented with figures to justify and reasons for choice of regressor used has been discussed.

Introduction

To forecast sales of a video game dataset using categorical variables, a machine learning model, such as a decision tree, random forest, or logistic regression, is used by preprocessing the data and converting the categorical variables to numerical features.

Methodology

I imported the necessary libraries, loaded the videogame data, checked the null and data type, preprocessed and cleaned the data, converted categorical variable to numerical variables, I split and selected a model to be trained the data.

Question a

The combination of 'Critic count', 'Publisher', 'Platform', 'Developer', 'Year of release', 'EU sales' , 'NA sales', 'JP sales', 'Other sales' gave a

mean absolute error of 0.05267719258574051 RMSE

of 0.21730478771501296

R-Squared Score of 0.974596534463229

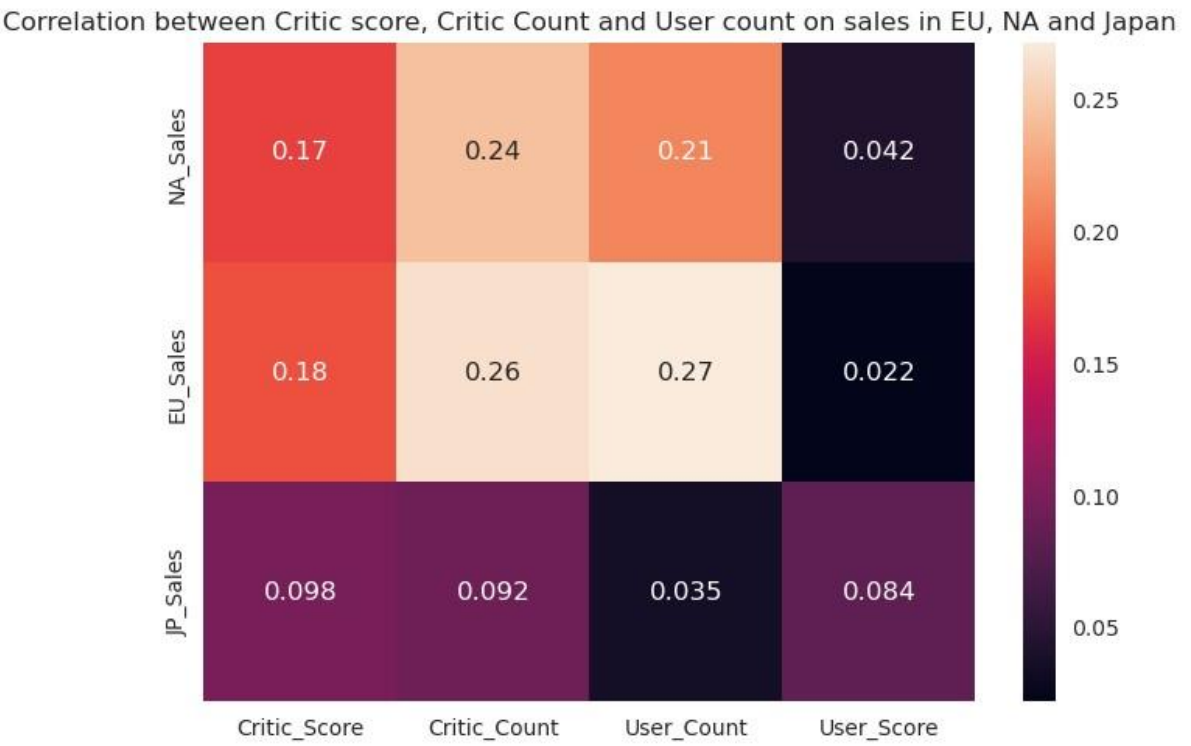
While a combination of all the variables and columns except the 'Global Sales' which is our target gave a value of

Model has a mean absolute error of 0.05237759510453901
RMSE of 0.21143641410467168
R-Squared Score of 0.9759500628040196

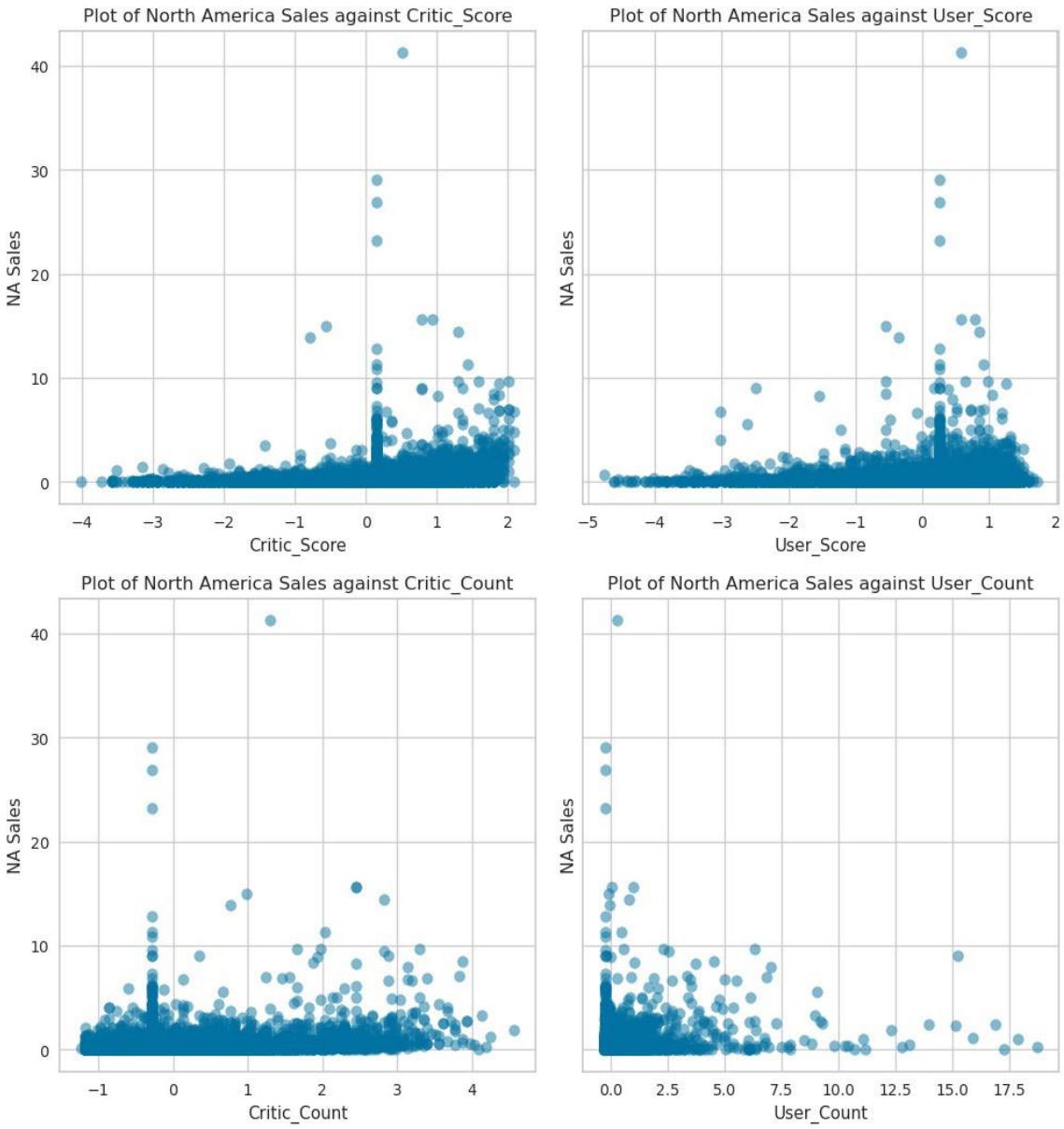
Hence, the variables except 'Global Sales' best predicts because it has the highest R square value and lowest mean square error.

Question b

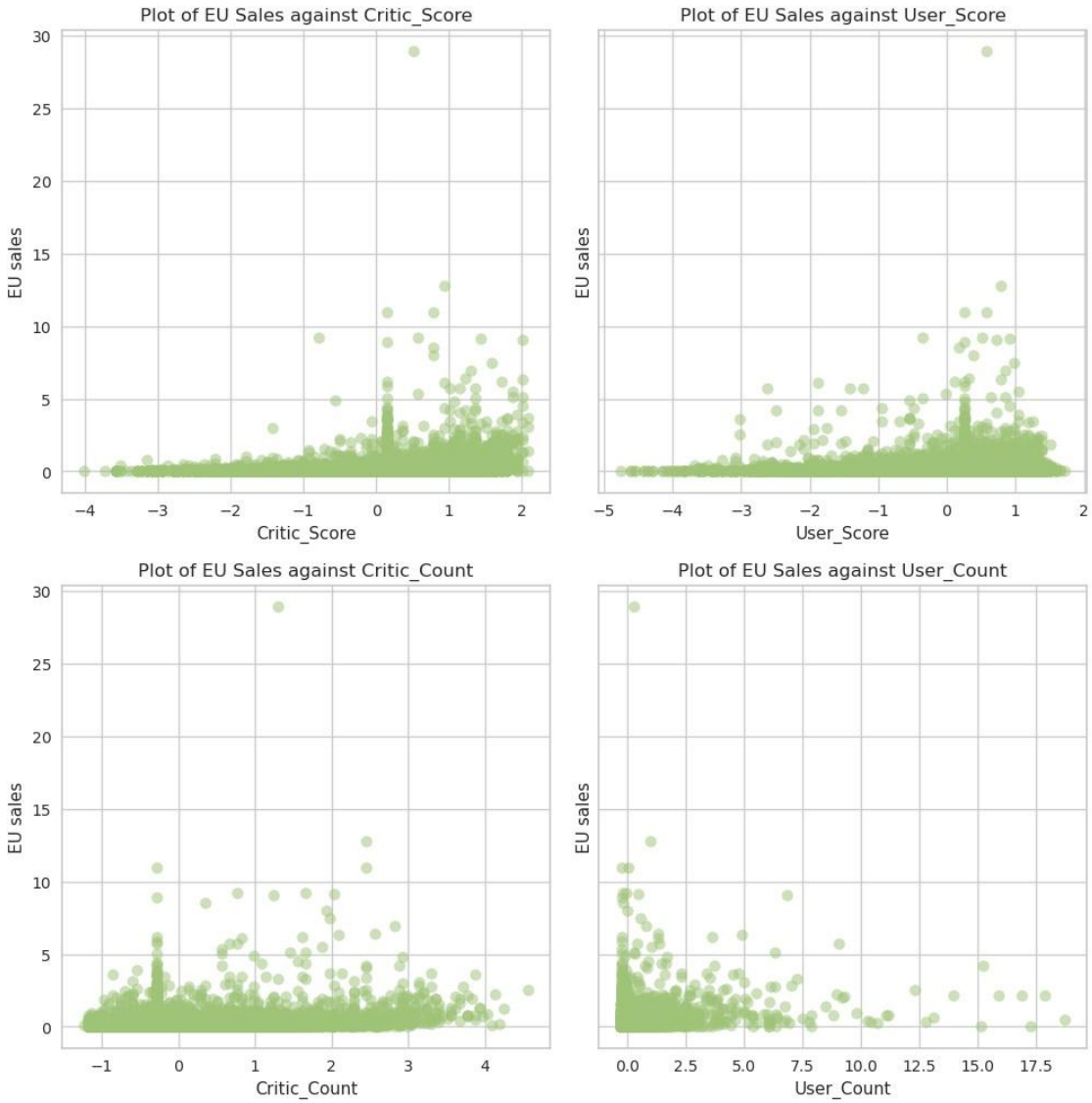
To determine the effects of critics, users and review scores on sales, a correlation analysis between the features was done and from the hit map presented, and no positive or negative correlation was observed.



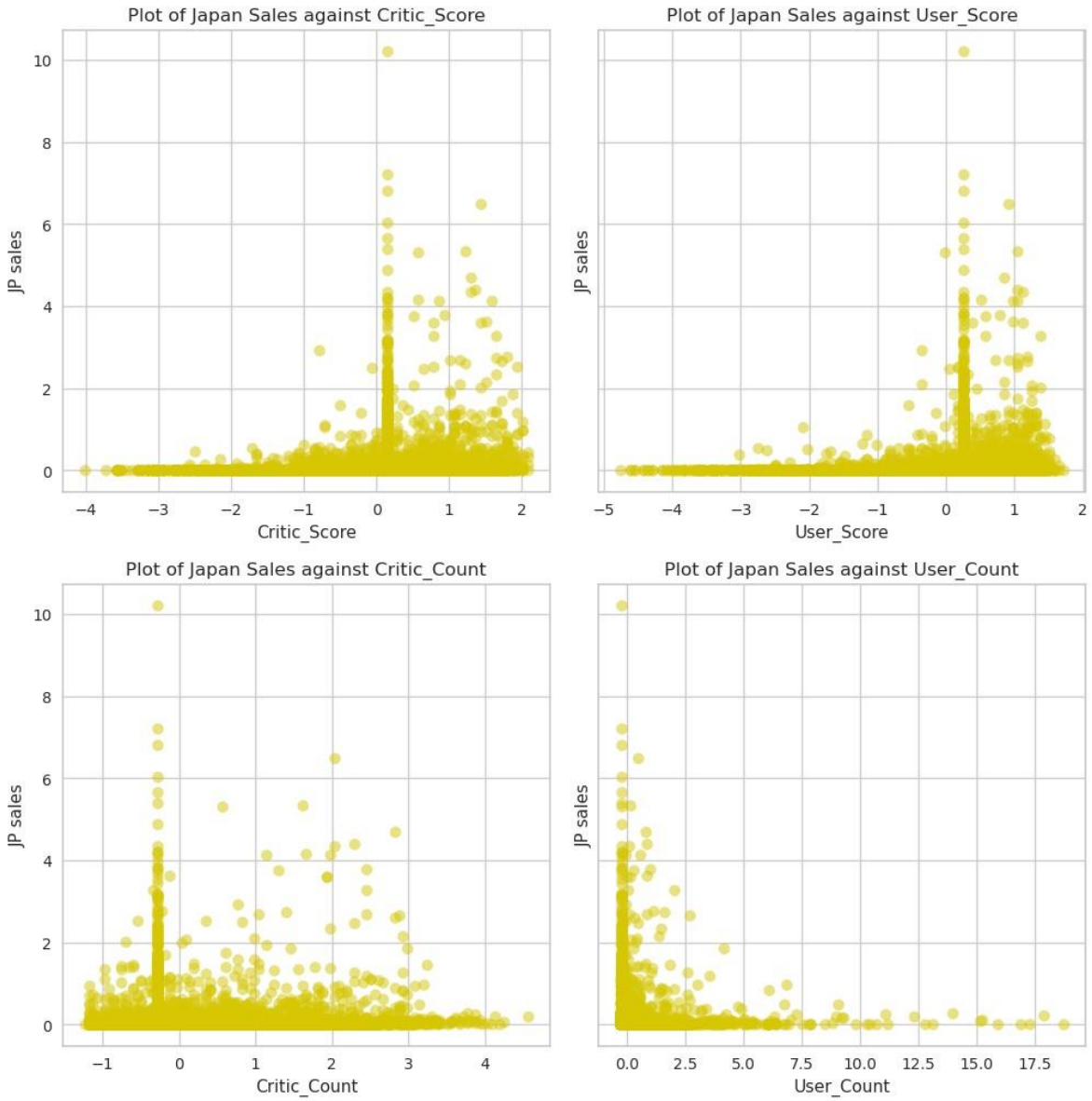
This plot shows a correlation analysis of count ,and scores against sales and no positive or negative correlation was discovered.



For the NA, the higher the positive critic score, the lower the sales, and the higher the critic count the higher the sales.



For EU, the higher the positive critic score, the lower the sales, and the lower the user and critic count, the higher the sales .



For Japan, the higher the critic score, the lower the sales and the lower the user and critic count, the higher the sales.

Question c

My choice of regressor is the Random forest regressor because it performed best among the others although the tree regressors did good but not when compared with the Random Forest Regressor.

	Model	MAE	MSE	RMSE	R2	RMSLE	MAPE	TT (Sec)
rf	Random Forest Regressor	0.0488	0.4780	0.5187	0.8890	0.0466	0.0558	6.0880
dt	Decision Tree Regressor	0.0636	0.3842	0.5105	0.8456	0.0544	0.0731	0.2950
et	Extra Trees Regressor	0.0786	0.9718	0.7849	0.7630	0.0655	0.0594	3.7830
ada	AdaBoost Regressor	0.2475	2.0403	1.2861	0.3241	0.1952	0.9710	1.0340
knn	K Neighbors Regressor	0.4319	2.3046	1.4113	0.1327	0.3530	2.3937	0.1980
par	Passive Aggressive Regressor	0.2865	1.7484	0.9609	-0.0422	0.2557	1.3092	0.0920
lasso	Lasso Regression	0.4646	2.7258	1.5462	-0.0529	0.4057	2.5943	0.1530
en	Elastic Net	0.4646	2.7257	1.5461	-0.0529	0.4057	2.5912	0.1090
llar	Lasso Least Angle Regression	0.4646	2.7258	1.5462	-0.0529	0.4057	2.5943	0.0800
dummy	Dummy Regressor	0.4657	2.7267	1.5465	-0.0536	0.4063	2.6350	0.1590
omp	Orthogonal Matching Pursuit	0.4655	2.7268	1.5466	-0.0537	0.4062	2.6253	0.0780

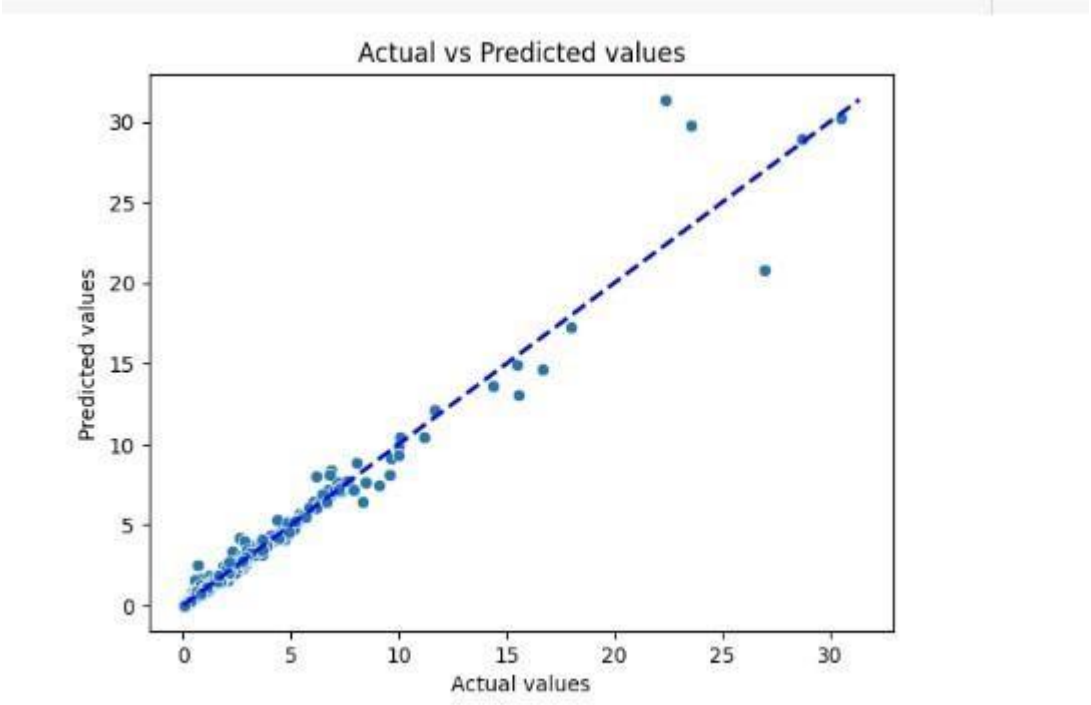
Presented above shows quantitatively that the Random Forest Regressor has the least Mean Absolute Error of 0.0488 when compared with the other Regression methods and the highest R square value of 88%.

Question d

```
Model_Accuracy while using"Developer" as target *********
model has accuracy of: 0.507
Model_Accuracy while using"Rating" as target *********
model has accuracy of: 0.757
Model_Accuracy while using"Genre" as target *********
model has accuracy of: 0.349
Model_Accuracy while using"Platform" as target *********
model has accuracy of: 0.555
Model_Accuracy while using"Publisher" as target *********
model has accuracy of: 0.306
Model_Accuracy while using"Name" as target *********
model has accuracy of: 0.055
```

- Developer: this variable had an accuracy of 50% when used as the target.
- Rating: this variable had an accuracy of 75% when used as the target
- Genre: this variable had an accuracy of 34% when used as the target
- Platform: this variable had an accuracy of 55% when used as the target
- Publisher: this variable had an accuracy of 30% when used as the target
- Name: this variable had an accuracy of 55% when used as the target

Question e



A scatterplot was used to show overfitting and it was seen that the predictions are moving in the same direction of the line and a best fit of the whole prediction line was drawn to show whether or not there is overfitting.

Question f

With a Model Accuracy level of 75%, Yes it can be deployed and Since this is a video game dataset and not a life related issue such as Health or Law, it can be deployed. **Question g**

```
Results using Rating for grouping
******************************
External Evaluation Measures
******************************
V-measure Score: 0.556
Rand Index Score: 0.432
Mutual Information Score: 0.556

Internal Evaluation Measures
******************************
Davies-Bouldin Index: 1.142
Silhouette Coefficient: 0.324
Results using Genre for grouping
******************************
External Evaluation Measures
******************************
V-measure Score: 0.085
Rand Index Score: 0.032
Mutual Information Score: 0.084

Internal Evaluation Measures
******************************
Davies-Bouldin Index: 1.147
Silhouette Coefficient: 0.346
Results using Platform for grouping
******************************
External Evaluation Measures
******************************
V-measure Score: 0.250
Rand Index Score: 0.107
Mutual Information Score: 0.244

Internal Evaluation Measures
******************************
Davies-Bouldin Index: 1.194
Silhouette Coefficient: 0.275
```

	Column	NO of Clusters	v_measure	rand_index	mi_score	db_score	s_score
0	Rating	9	0.556290	0.432383	0.555855	1.141979	0.323833
1	Genre	13	0.085223	0.031595	0.083502	1.146540	0.346422
2	Platform	31	0.250109	0.106658	0.244057	1.193534	0.275118

Result and Conclusion

From the report analysis a combination of variables except the target/label (Global Sales) best predicts and the best choice of regressor is the Forest Regressor due to its low error of 0.04 and high accuracy of 88% and it was decided that an accuracy of 75% for model rating can be deployed in the sales of video games.

COMPONENT THREE REPORT (Handwritten Digits Recognition)

Abstract

This report correctly classifies handwritten digits in the given MNIST dataset by using Convolutional Neural Network i.e. CNN. I have used two (2) different regularization methods (L1 and L2) and evaluated how these methods have affected the CNN model performance quantitatively, changes I made to the number of convolution blocks were reported and how they affected the model performance, effects and overfitting have also been observed.

Introduction

CNNs are mainly used to solve complex image-driven pattern recognition tasks and with their accurate, yet simple architecture, it offers a simplified method that is used in computer vision tasks such as: Recognition of images, Detection of objects and classifying images, also the Convolutional layer is the most important aspect of the CNN architecture.

Methodology

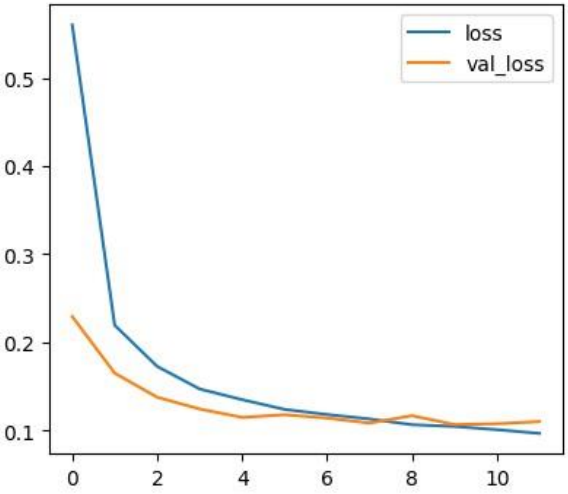
I have employed different methods to arrive at a conclusion which I have stated in the later part of this report.

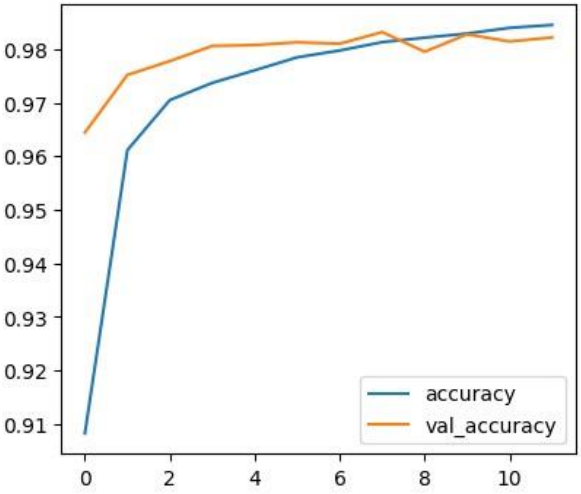
1. **Imported the necessary libraries** such as: tensor flow, NumPy, matplotlib, etc.
2. **Loaded the dataset:** I loaded the MNIST dataset containing the labeled samples for both training and testing.
3. **Preprocess the data:** I preprocessed the Image data for modelling where I have reshaped before modelling, using grayscale, 1-Channel Images (Image pixel tensors)
4. **Building of the model:** this is basically the construction stage which specified input shape as :`INPUT_SHAPE = (28, 28, 1)`
5. **Model compilation:** the loss is specified here.
6. **Model Training:** I trained the model for 100 epochs to check the performance, and applied an early-stopping to stop the model training once I did not see an improvement in validation-loss over the last 2 epochs using the Early Stopping call-back.
7. **Model Evaluation:** This was carried out to check for accuracy and loss.
8. **Model Testing:** This was done to make predictions on the new data.
9. **Visualization:** Visualization of the model was done using tools such as: Confusion Matrix, Matplotlib, classification report to visualize the results such as accuracy, labels, etc. with plots

PROVIDED ANSWERS TO QUESTIONS

a. The different regularization methods I used are L1 and L2 regularization, and the plot below shows that for:

   L1 regularization method loss = 0.1014
   Accuracy= 98%

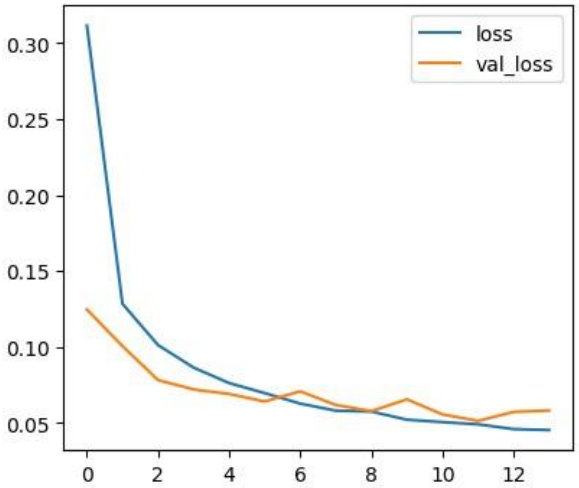


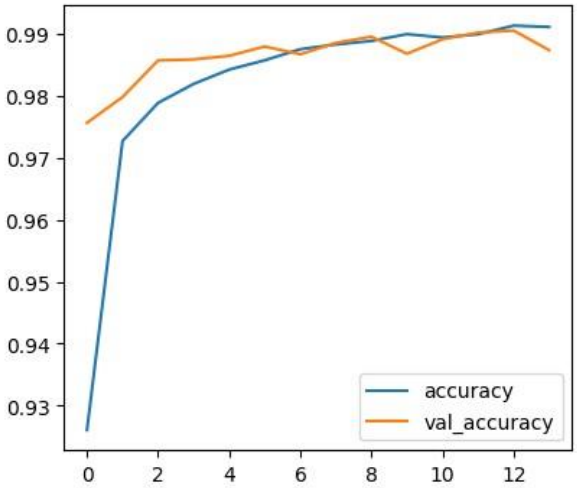


While for L2 Regularization,

Loss = 0.0460

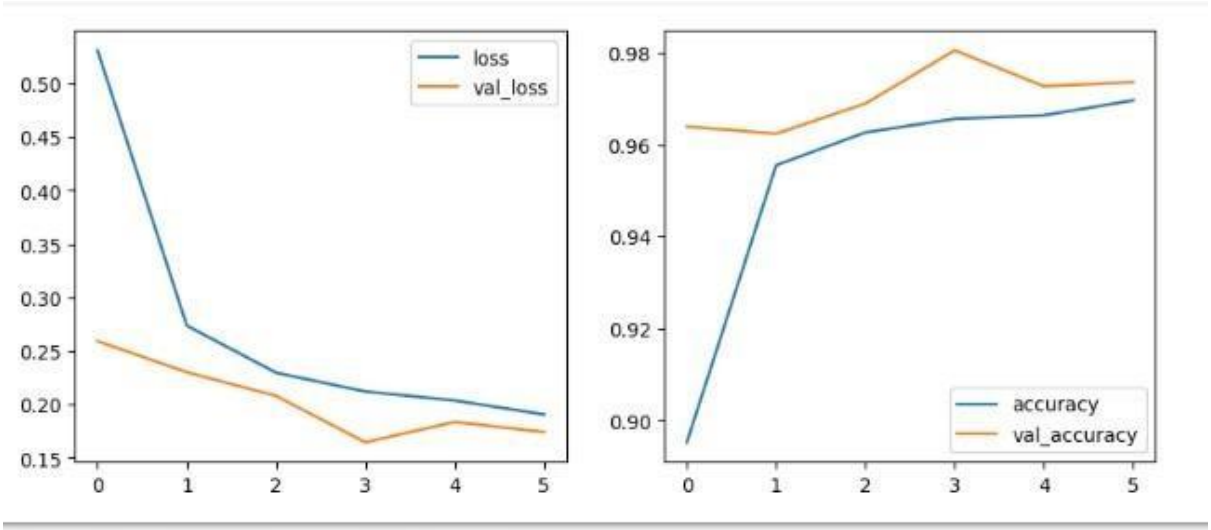
Accuracy =99%





From the above plots and values, it shows that L2 Regularization gave a better Model performance with the lowest value error of 0.04 and higher accuracy of 99% while L1 with the value error of 0.1 and accuracy of 98%.

b. Increasing the number of Con2D blocks from 2 to 3 blocks reduced the performance of the Models but using 2 blocks gave the best performance.



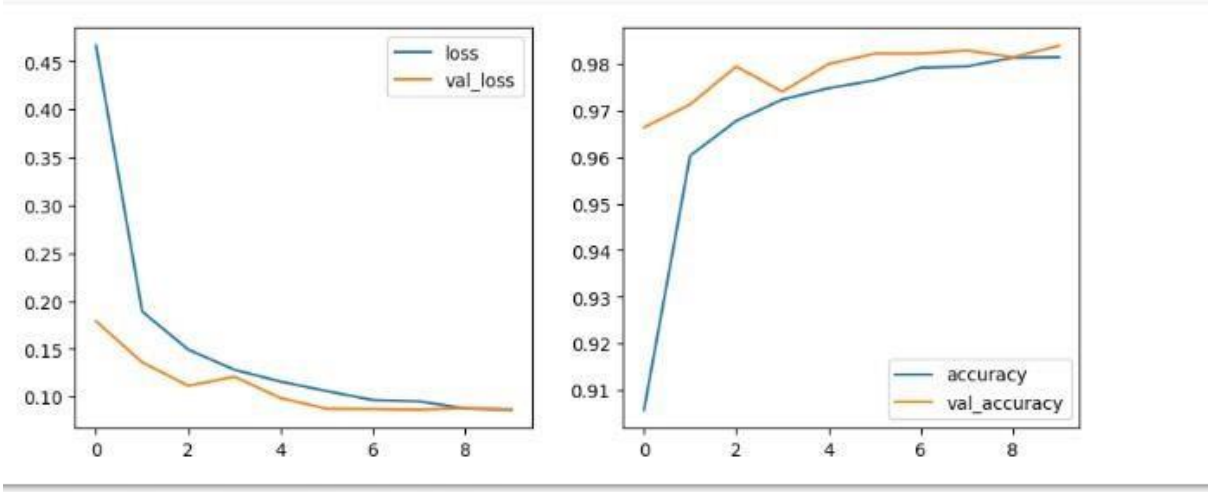

```
model.evaluate(test_images_scaled,test_labels)
```

```
313/313 [==============================] - 1s 3ms/step - loss: 0.1638 - accuracy: 0.9788
[0.16377946734428406, 0.9787999987602234]
```

from the above plot, increasing the number of blocks reduced the Model performance with an accuracy of 97% and loss of 0.1638.

c. The varying learning rates used are :0.1, 0.01, 0.001

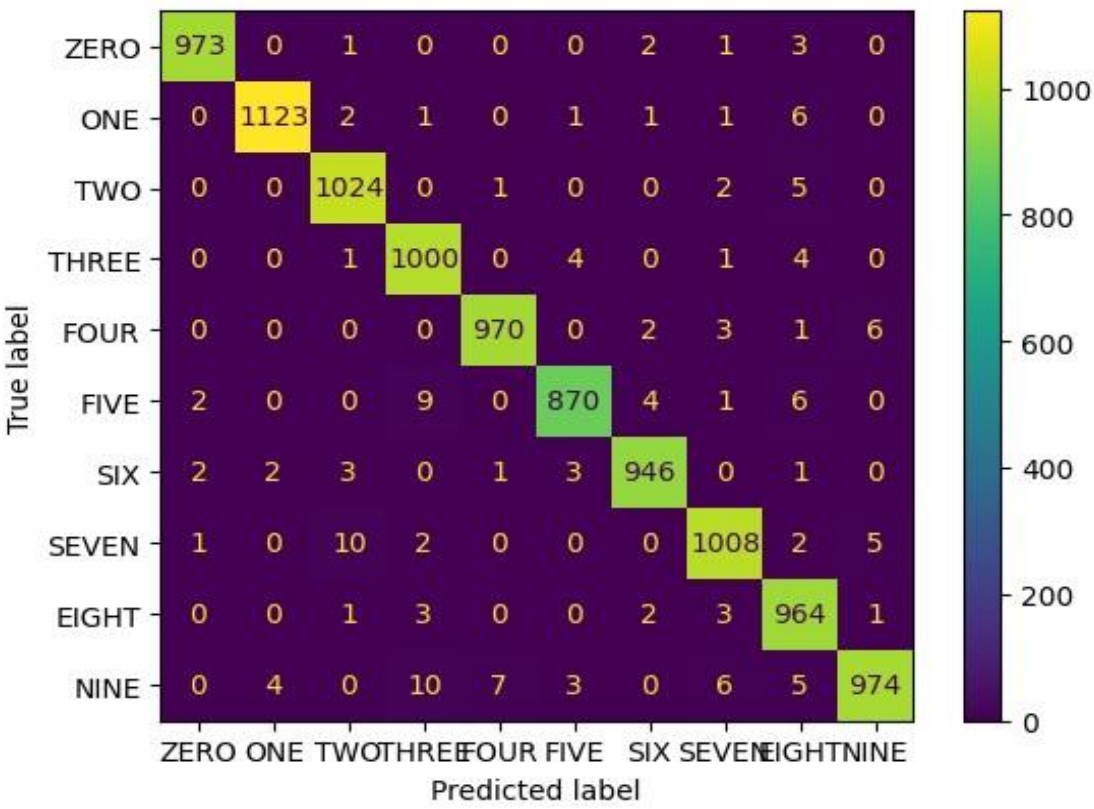
Using the varying rate of 0.1



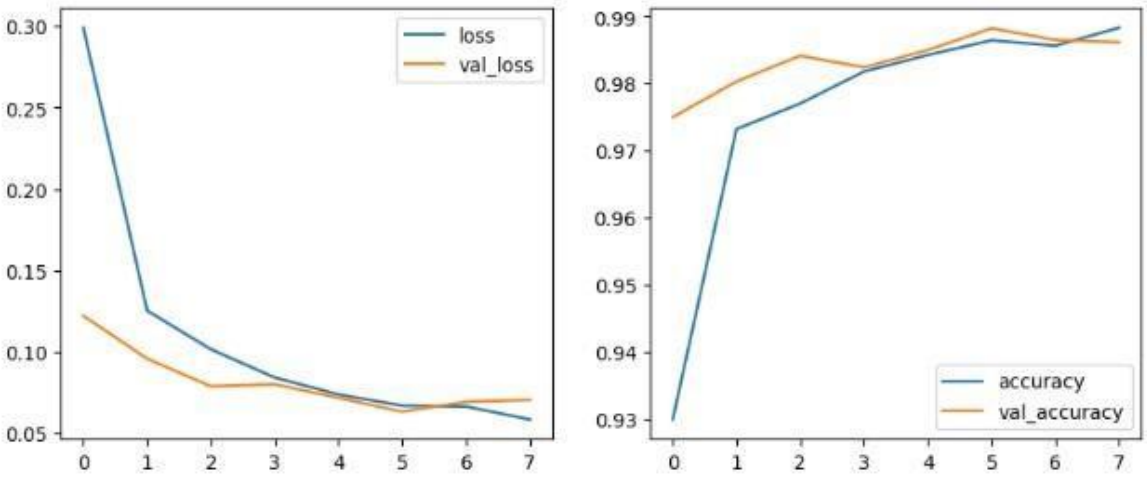

```
lr1_model.evaluate(test_images_scaled,test_labels)

313/313 [==============================] - 2s 4ms/step - loss: 0.0745 - accuracy: 0.9852
[0.07448984682559967, 0.9851999878883362]
```

Error = 0.07
Accuracy = 98%



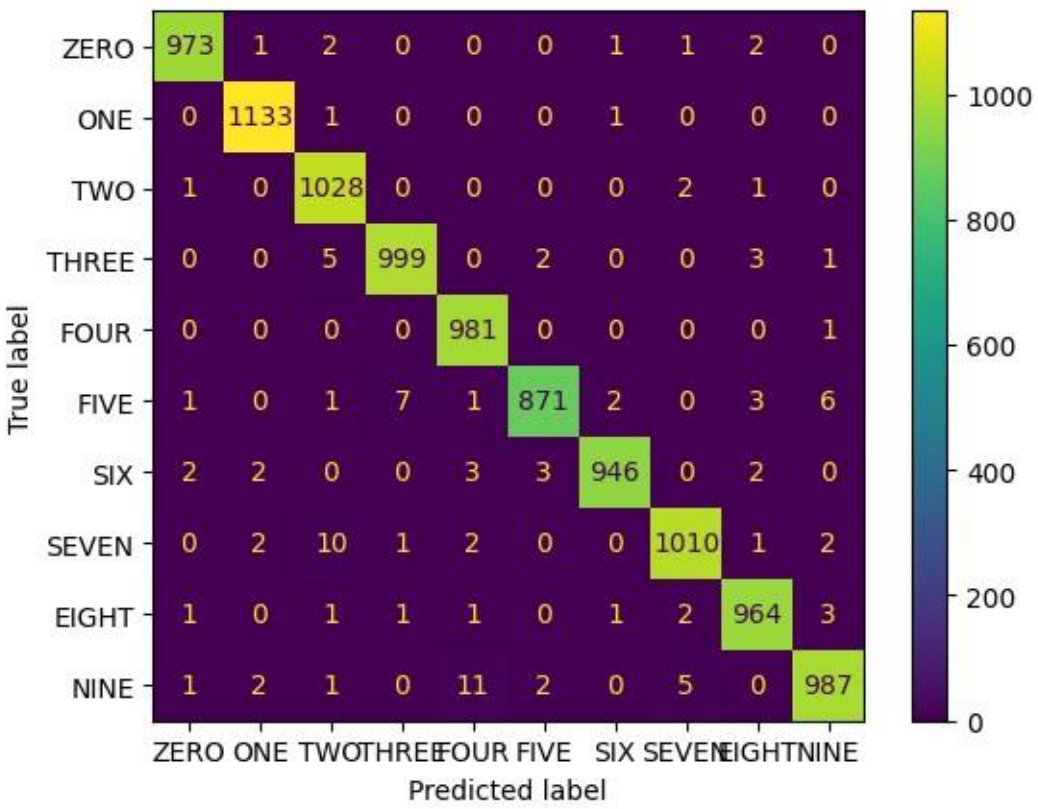
Using varying rate of 0.01



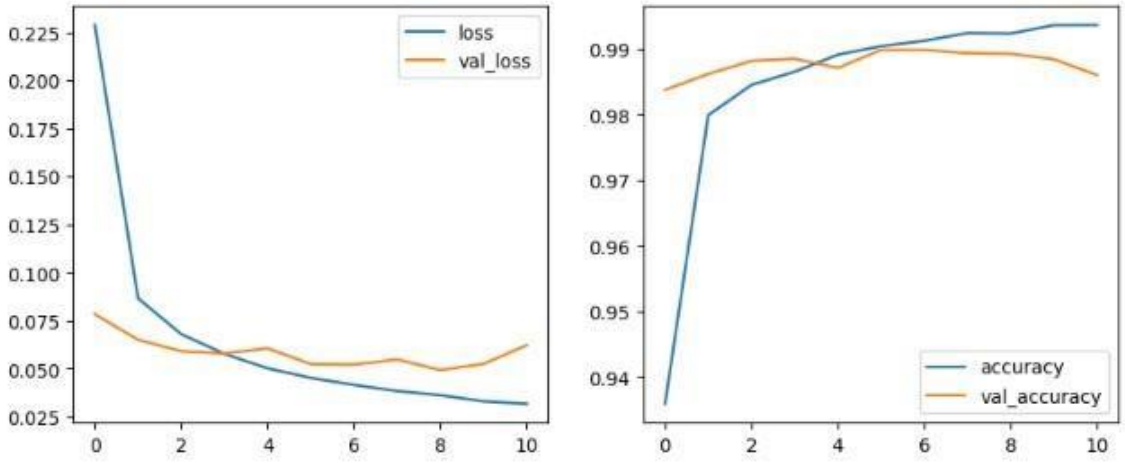

```
lr2_model.evaluate(test_images_scaled,test_labels)
```

```
313/313 [==============================] - 1s 3ms/step - loss: 0.0537 - accuracy: 0.9892
[0.05366748571395874, 0.9891999959945679]
```

Error = 0.05366748571395874
Accuracy = 0.9891999959945679



Using varying rate of 0.001

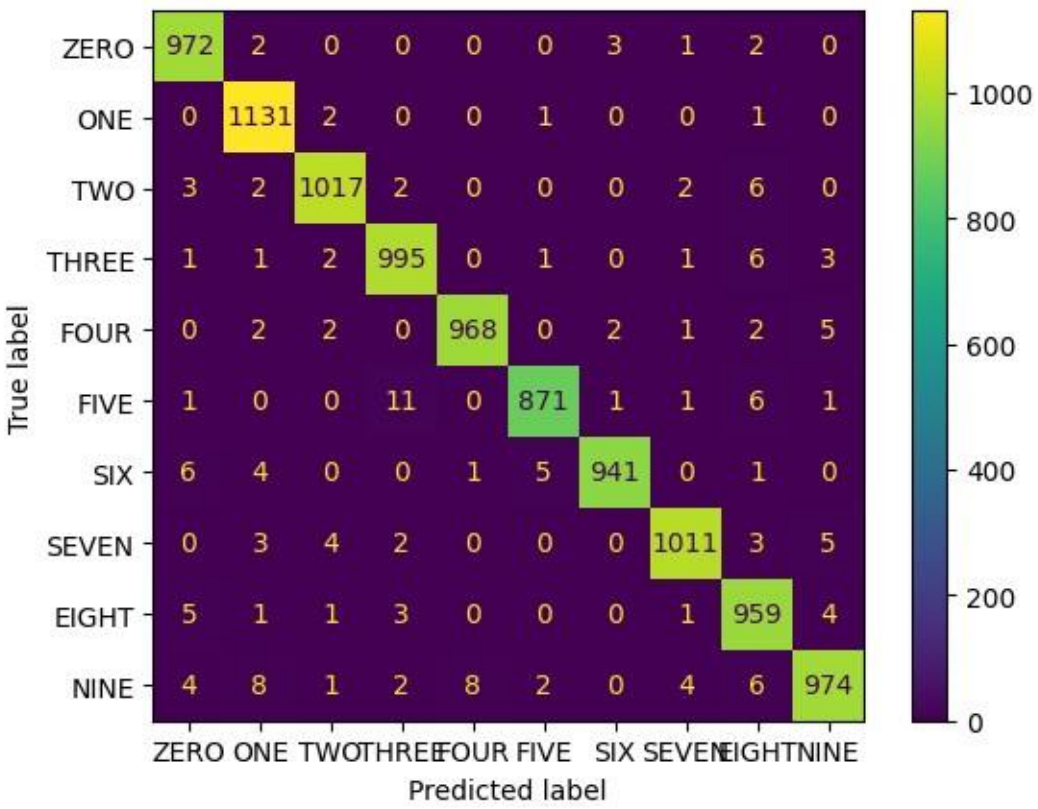



```
lr3_model.evaluate(test_images_scaled,test_labels)
```

```
313/313 [==============================] - 2s 5ms/step - loss: 0.0444 - accuracy: 0.9904
[0.04439963772892952, 0.9904000163078308]
```

Error = 0.044

Accuracy = 99%



For the L regularization, correct outputs on the labels were observed across both labels.

d. After changing the number of blocks and checking varying learning rates, the Model did not overfit at any point.

CONCLUSION

From the above analysis, it was observed that the lower the learning rate, the better the performance also, the higher the number of convolutionary blocks, the lower the Model performance.

ETHICS OF AI IN EDUCATIONAL SERVICES INDUSTRY

Abstract

Artificial Intelligence is rapidly expanding in all areas of life including Education, the ability to review a more global horizon oh how AI is perceived is necessary to the enhancement of a better user experience in the Educational sector ,and a proper update on the portfolios of various Educationalists

Introduction

Education in itself is a depth of knowledge and the combination of AI makes it even more necessary to review as the world is driven by technologies, it is pertinent to keep abreast for the sake of the future generation

Methodology

I have reviewed three journals for the purpose of this report and I have been able to review the ethical compliances, gaps, solutions and possibly future suggestions on how to breach these gaps.

Aims and contributions.

Article 1: To explore a global insight on AIED by evaluating international organizations' strategies and establish prospects presented by AI.

Article 2: Aims to examine present ethical principles and how they inform AI ethics policies for children and K-12 education and contributes by locating recent and relevant statements in K-12 education and carrying out analysis on these documents.

Article 3: To discuss what Responsible and Trustworthy AI is and how it affects Education.

CONNECTIONS

- There is need for **transparency** of Data use in AIED as transparency lies in the data itself, where it is collected, as it portrays the learning history and ability of the individual.
- The ethical principle for **Fair AI** regulates policies that ensure children are wellincluded in AI literacy, prioritized and not discriminated against.
- Socially responsible AI in Education ensures that Research and use of AI should be done in a responsible manner, meet binding legal obligations and generally ensure the well-being of the society.

CHALLENGES

- Individual challenges range from critical societal setbacks, such as: system bias, inequality of marginalized categories of students, and their ability to learn.
- A major challenge is breach of learner's privacy, user confidentiality and consent.
- Consequences arise from misuse, overconfidence in AI, Abuse or underutilization.

EMPHASIS ON NEED TO ADDRESS THESE CHALLENGES

Addressing the gaps is necessary to ensure that the Level to which these technologies are adopted by Educationalists are guided by some sort of Government regulation implemented to curb misuse and privacy breach and also avoid a future where AI pervades true learning by students.

SUGGESTIONS ON HOW TO BRIDGE GAPS

- Provision of concrete and Legally binding proposals for Trustworthy and Responsible AI from Government and policymakers to avoid misuse and abuse
- Principles of AI ethics should be embedded in Education or Educational Research, Teaching and learning.
- More information should be dispersed to Educationalists to guide them within the principles of AI ethics and reduce claims or Real or feigned ignorance.

Results and Conclusion

The government has a huge role to play in maintaining ethical values in AI and more information should be made available on how ethical AI affects the Educational system globally.

LIST OF REVIEWED ARTICLES

Reference list

Adams, C., Pente, P., Lemermeyer, G. and Rockwell, G. (2023). Ethical principles for artificial intelligence in K-12 education. *Computers and Education: Artificial Intelligence*, p.100131. doi:https://doi.org/10.1016/j.caeai.2023.100131.

Dignum, V. (2021). The role and challenges of education for responsible AI. *London Review of Education*, 19(1). doi:https://doi.org/10.14324/lre.19.1.01.

Nguyen, A., Ngo, H.N., Hong, Y., Dang, B. and Nguyen, B.-P.T. (2022). Ethical principles for artificial intelligence in education. *Education and Information Technologies*. doi:https://doi.org/10.1007/s10639-022-11316-w.