

# An Introduction To Machine Learning Games And Its Application For Kids In Fun Project

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**Abstract**— Industrial Revolution 4.0 is the right time to democratize artificial intelligence in the world. It can be started from education, the target is the level of elementary, middle and high school. But the general curriculum still around in natural science, social science and language science. The challenge is how to introduce artificial intelligence earlier to the student and how to combine its material with the curriculum. “Machine Learning for Kids” is a web-based application which kids can explore artificial intelligence, especially in machine learning field with a fun project. The application provided to create a new project like animal classification. Kids can add a new label, such as mammal, insect, amphibian, bird, fish and etc. They have to add the animal name as an example of training data into each label. After kids added the training data, they can create the machine learning model. The experiment showed the confidence of the machine learning model test with a member of example reached 100%, the label prediction of all example was accurate. While the confidence of machine learning model test with another member of example reached between 14-17%, the label prediction of all example was also accurate. We recommended “Machine Learning for Kids” is one of the best web-based application for kids to explorer machine learning easily.

**Keywords**—Artificial Intelligence, Machine Learning, Kids, Games, Fun Project

## I. INTRODUCTION

Since the industrial revolution 4.0 has been socialized in several countries, including Indonesia. This fourth-generation industrial revolution can be interpreted as the combination of an intelligent and automated system in industry. It is driven by data through machine learning and AI technology. Some of them are improving automation, machine-to-machine communication, human-to-machine communication, AI, and continuous technology development [1]. To realize it, there are

driving factors, such volume of data, computing power, connectivity and an increase in analytical and business intelligence capabilities in the industry [2]. The most important thing is to increase human resources both knowledge and skills.

The democratization of artificial intelligence in Indonesia can be started from education, the target is the level of elementary, middle and high school education. For higher education, the curriculum can be adapted to industrial needs [3]. The characteristics of the school curriculum in Indonesia are quite varied, including majoring in natural science, social science and language science. The challenge is how to introduce artificial intelligence to students earlier, but still provide the core material of each class major. This allows for a combination of artificial intelligence material with each field.

Artificial intelligence has many branches of science, one of which is machine learning. Machine learning is a type of Artificial Intelligence (AI) that provides computers with the ability to learn from data, without explicitly following programmed instructions [4]. In general, machine learning is divided into two learning models, namely supervised learning and unsupervised learning. Supervised learning is a technique of forming a data model through a process to declare a data object (consisting of features) to a predefined category (class label). Meanwhile, unsupervised learning works by grouping data with the same characteristics into the same cluster, and grouping data with different characteristics to another cluster [5].

To teach machine learning to the school student such as kids, it is the different way from teaching college students and adults. Kids need certain media to learn machine learning easily and according to their age. Many web-based, mobile and other platform applications support this. One of them is a web-based application called “Machine Learning for Kids” which

was developed in the UK. Therefore, this study tries to introduce machine learning applications to kids into a fun project using “Machine Learning for Kids”.

## II. RELATED WORKS

Candello, H. et al, proposed the research about 30 minutes to introduce AI to kids. The research discussed how to design a science museum to provide learning the concept of artificial intelligence in an interesting, practical and fun way for 30 minutes. Learning activities would be guided by a museum guide. The artificial intelligence system was designed in a series of activities between kids with three AI-powered talking heads who have the ability to answer questions. The system learned from each of the questions asked. Three AI-powered talking heads challenged to answer and they improved the abilities [6].

Hiltron T. et al, proposed the research about introducing kids to machine learning concepts through hands-on experience. The research assessed kids who 0-12 years old to understand machine learning concepts with a set of supports such as digital sticks in WoZ (Wizard of Oz) based game model. WoZ is known as a rapid prototype research method. WoZ simulates users can interact directly with technology and provide mutual feedback. The research also tested kid's understanding with the pre-test, sign recognition training, and post-test. In addition, the research validated the understanding of motion training, motion detection processes and machine learning processes that were tested on kids every day. The research concluded that children were able to understand machine learning concepts well, even carried out activities in new contexts. The learning activity allowed children to carry out activities according to the example they want and re-evaluate their own way [7].

The other research, Hiltron T. et al, proposed the research again about introducing kids to machine learning concepts through uncovering black boxes. The research proposed a different approach, where machine learning generally only looks like a black box, it exists but it is not understood how it works. Kids need to learn machine learning media, it given the opportunity to develop their own machine learning models. The research provided a learning platform for kids to easily learn machine learning through data labelling and evaluation. The platform provided a creative space for kids through the interaction of physical movements, for example making a circle, square and other shapes, then re-sampling and they can evaluate it. The understanding being tested what kids can practice making a shape sample only, practice evaluating sample only, or both. The research showed that both elements were very important [8].

## III. RESEARCH METHODOLOGY

This chapter discussed how the research methodology was proposed to kids can learn machine learning a fun way. We choose the best alternative of a web-based machine learning application called “Machine Learning for Kids”. Fig. 1. showed the proposed system design of machine learning for kids in a fun project. The proposed system design illustrated kids (user) playing a smartphone, accessing the platform, then

starting a new project. User can create a project by selecting the object recognition based on text, images, numbers, or voice. Then the user can add a new label as a category of training data, then add several samples according to the label. If the user completes the labels and samples, they can train the machine learning model. After the model is created, the user can test the model with the sample which unknown label. The model will predict the label of sample.

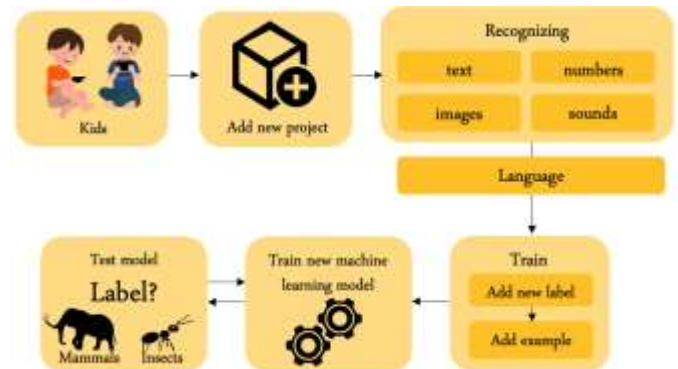


Fig. 1. Proposed system design of machine learning for kids in a fun project

### A. Object Recognition

“Machine Learning for Kids” provides user with several choices of object recognition. They are text, number, image and sound-based recognition. In real cases, the data is used as input in machine learning is known as a feature. The feature comes from text data, numbers, images, sound, video, maps, and other forms of data. The application provides language option that are recognized by the system, including English, Arabic, Chinese, Czech, German, French, Italian, Japanese and others.

### B. Train Sample

All machine learning applications need a sample to learn. Machine learning has input type dataset which is known as supervised datasets and unsupervised datasets. The supervised dataset consists of features and labels, while the unsupervised dataset consists of features only without labels. “Machine Learning for Kids” also provide the filling out labels and samples in the field, while the number of samples requires at least five samples.

### C. Train New Machine Learning Model

After user input labels and samples, “Machine Learning for Kids” provides train the machine learning model that can learn the sample patterns. The algorithms that work in background process is known as Artificial Neural Networks or more specifically known as Deep Learning. The algorithm consists of several layers, including input layer, hidden layer and output layer. Neural Network simulates the workings of the human brain, where there are a number of input features. The feature is the sample which has characteristics. The next layer is a hidden layer like a black box. The last is the output layer will predict the label of the sample which has an unknown label before.

#### D. Test Model

If the model has been created, the model is ready to be tested. "Machine Learning for Kids" provides a test scenario for the user, where the user can enter a test sample into the system. The model will predict labels that are close to the sample characteristics. The prediction can generate both the right result or wrong result. However, "Machine Learning for Kids" does not only provide output labels, but also a percentage of the prediction confidences.

#### IV. EXPERIMENT RESULT

Kids can access "Machine Learning for Kids" apps at <https://machinelearningforkids.co.uk> to start the project. User can get started the project, the option chooses the button 'sign up' for the first time here, 'log in' for already registered, and 'try it now' for a try without registering. In this experiment would be explained with the scenario using try the project without registering. Fig. 2 showed the user can choose 'add a new project' button.



Fig. 2. Add a new machine learning project

While Fig. 3. showed the user can start a new machine learning project, the user fills out the form consist of the project name, and recognizing types such as text, number, image and sound. This experiment used text as object recognition and the language must be chosen, such as English. After the user fills out all the columns, the user can choose the 'create' button.

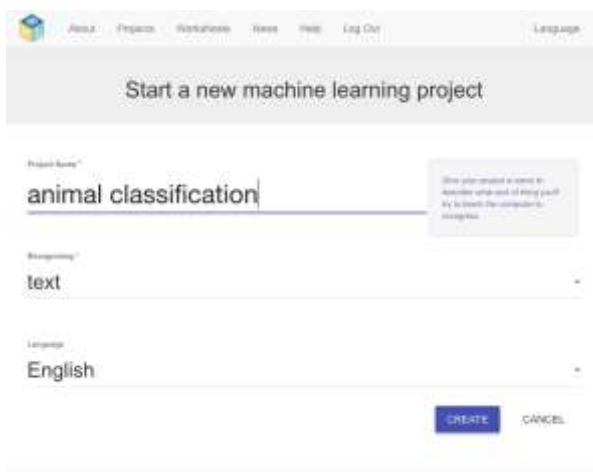


Fig. 3. Start a new machine learning project

Fig. 4. showed the machine learning project which was created by the user. This experiment was given name the

project with entitled 'animal classification'. The user can choose the dialog box to move the next process. On other hand, the user can delete the project.



Fig. 4. Machine learning project name

After the project name was created, the user starts to train, learn, and test the machine learning model. Fig. 5. showed the user chooses 'train', 'learn & test' button. 'Train' is a step to collect the example what the user wants the computer to recognize. 'Learn & test' are step to use the examples to train the computer to recognize text. For the advanced feature is 'Make', to use the model the user has trained to make a game or app such as in Python, Scratch, or App Inventor.

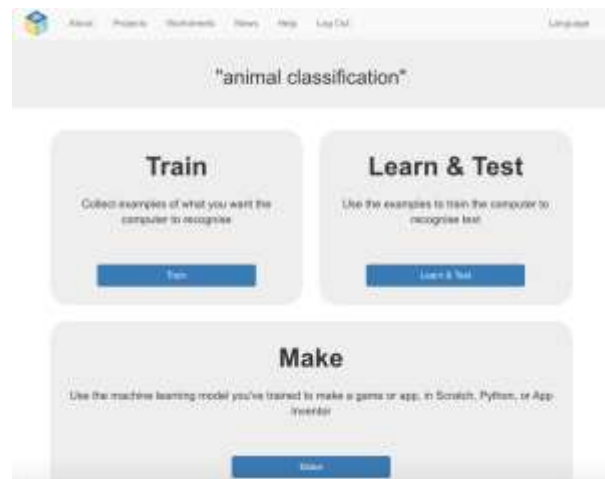


Fig. 5. Train, learn & test the machine learning project

If the user chooses 'Train', the user can add label and example. For example, user add new label "Mammal" and "Insect". Each label can be filled out with an example, such as:

- Mammal: pig, horse, monkey, cow, and cat
- Insect: spider, ant, fly, firefly, and butterfly

Fig. 6. showed the dialogue box consists of two labels, mammal and insect. The user not only can add two labels but also add more labels. The user is allowed to add the new type of animals such as reptile, amphibian, fish, and bird.

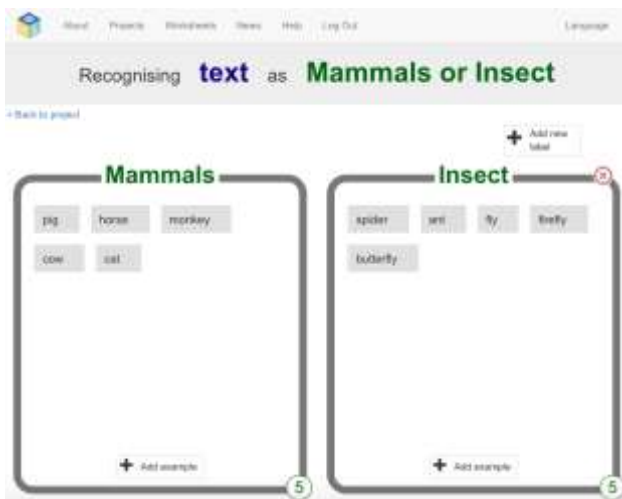


Fig. 6. Add new label and example

After the user was added the label and example, the user can train the new machine learning model in the menu 'Learn & Test'. Fig. 7. showed the 'Train new machine learning model' button. If the user chooses the button, it will generate the model in the background process. The user has collected 5 examples of mammal and 5 examples of insect. The user waits in a minute until the machine learning model was created.

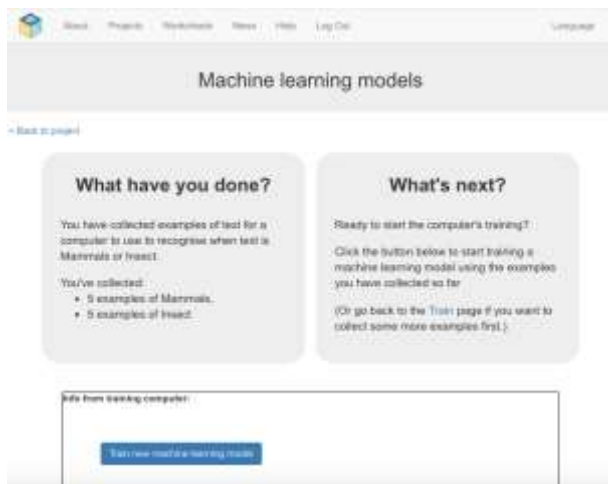


Fig. 7. Train new machine learning model

If the model was created, it means the user can test the model with various testing data. Fig. 8. showed the information about the date-time of the model started training, the current model status (available or not), and the date-time of the model will be automatically be deleted. But it is a temporary model because the user tries the application without registration. The user is also can put some text in a field to see how it is recognized based on their own model. The next step is how the user can input some examples as testing data to know the accuracy of prediction based on the machine learning model.

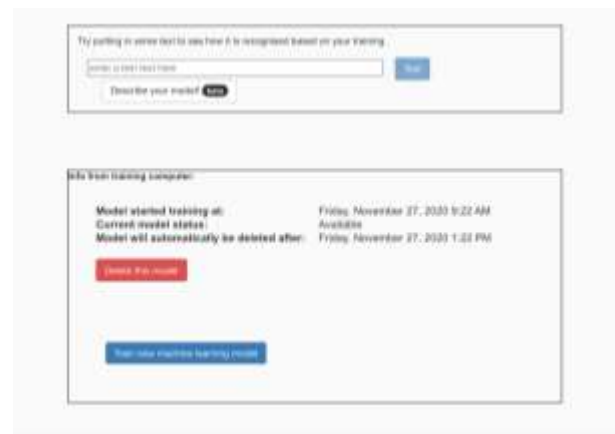


Fig. 8. Machine learning model trained

The final step is the user can put some text as testing data. For example, Fig. 9 showed scenario of test machine learning model with the target is a mammal class, while the testing data is a member of example. When the user input 'cow', the object 'cow' would be recognized as a mammal. The confidence of prediction reached 100% because the model has been recognized the example before.



Fig. 9. Test machine learning model in mammal class with member of example

The different test in Fig. 10. showed the confidence of prediction reached 15% only. It happened because the model was tested by another member of example. 'Elephant' is not yet on the training data, but the model predicted the accurate label. The model known that 'elephant' is a mammal. It was really tested, the model is not the only test with their member, but also test with another member to know the robustness of the model.



Fig. 10. Test machine learning model in mammal class with another member of example

Fig. 11. showed scenario of test machine learning model with the target is insect class, while the testing data is another member of example. When the user input 'firefly', the object 'firefly' would be recognized as an insect. The confidence of prediction reached 100% because the model has been recognized the example before. It is the same case with the mammal class.





Fig. 11. Test machine learning model in insect class with member of example

Fig. 12. showed the confidence of prediction reached 15% only. It happened because the model was tested by another member of example. ‘Dragonfly’ is not yet on the training data, but the model predicted the accurate label. The model known that ‘dragonfly’ is an insect. All tested scenario proved that the animal classification model has accurate model trained. Kids can explore with additional of other animal class.



Fig. 12. Test machine learning model in insect class with another member of example

The prediction accuracy of test machine learning model with a member of example certainly reached 100%, because the model has been recognized the example before. But in Table 1. showed the prediction accuracy of test machine learning model with another member of example. ‘Sheep’, ‘Tiger’, and etc. are the member of mammal class, while ‘beetle’, scorpion, and etc. are the member of insect class. The model has been recognized the all the testing data with accurate prediction and given the confidence between 14-17%. The test showed that the model has good performance to predict all another member of example in mammal and insect class.

TABLE I. THE PREDICTION ACCURACY OF ANOTHER MEMBER OF EXAMPLE IN MAMMAL AND INSECT CLASS

Animal Class	Name	Confidence	Prediction (True/False)
Mammal	Sheep	17%	True
	Tiger	15%	True
	Lion	15%	True
	Elephant	15%	True
	Hippopotamus	15%	True
Insect	Beetle	13%	True
	Scorpion	14%	True
	Dragonfly	17%	True
	Fleas	14%	True
	Centipedes	15%	True

## V. CONCLUSION

Kids explore their world in various games and applications what they want. But we need to bring kids to know about artificial intelligence and machine learning for their future. “Machine Learning for Kids” offer learn machine learning easily, kids play the web-based application and train their logic.

The application provided set up to create a new project like animal classification. Kids can add a new label, such as mammal, insect, amphibian, bird, fish and etc. They have to add the example of training data into each label, such as mammal: {pig, horse, monkey, cow, and cat} and insect: {spider, ant, fly, firefly, and butterfly}. After kids added the training data, they can create the machine learning model. The experiment showed the confidence of the machine learning model test with member of example reached 100%, the label prediction of all example was true. While the confidence of machine learning model test with another member of example reached between 14-17%, the label prediction of all example was also true. We conclude “Machine Learning for Kids” is one of the best web-based application which it recommends for kids to explorer machine learning.

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