

Handwritten Equation Solver

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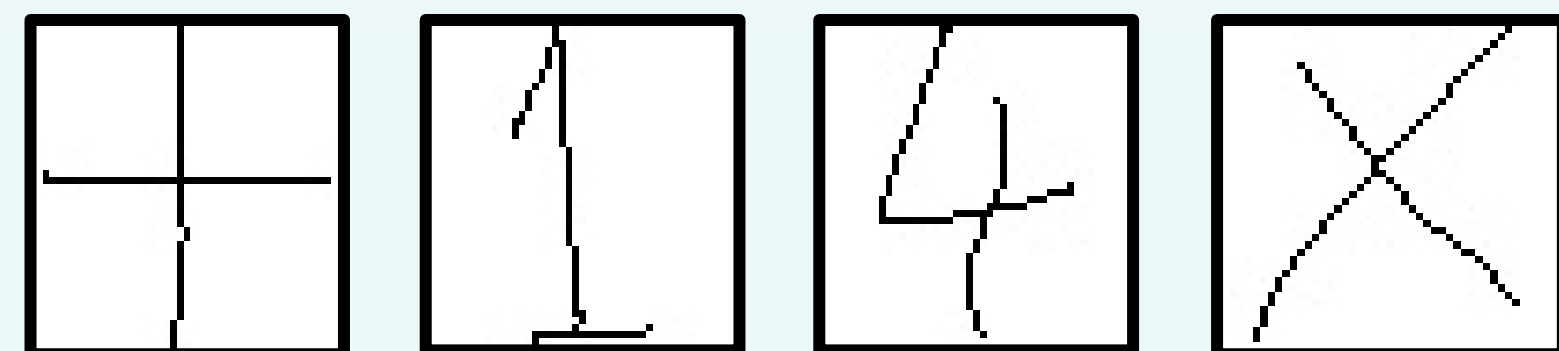
INTRODUCTION

Solving mathematical equations is an integral part of science right from basic schooling to major research applications. The computing power of today can give a great boost to solving mathematical equations at all levels. Given the level of complexity a mathematical equation can reach, it is simpler and faster to write it by hand than type it on a computer. A machine learning enabled handwritten equation solver can be a very important tool to simplify calculations.

The aim of [this project](#) is to build a deep learning model that can recognise handwritten numbers and mathematical symbols, read it as an equation and evaluate it to give the solution.

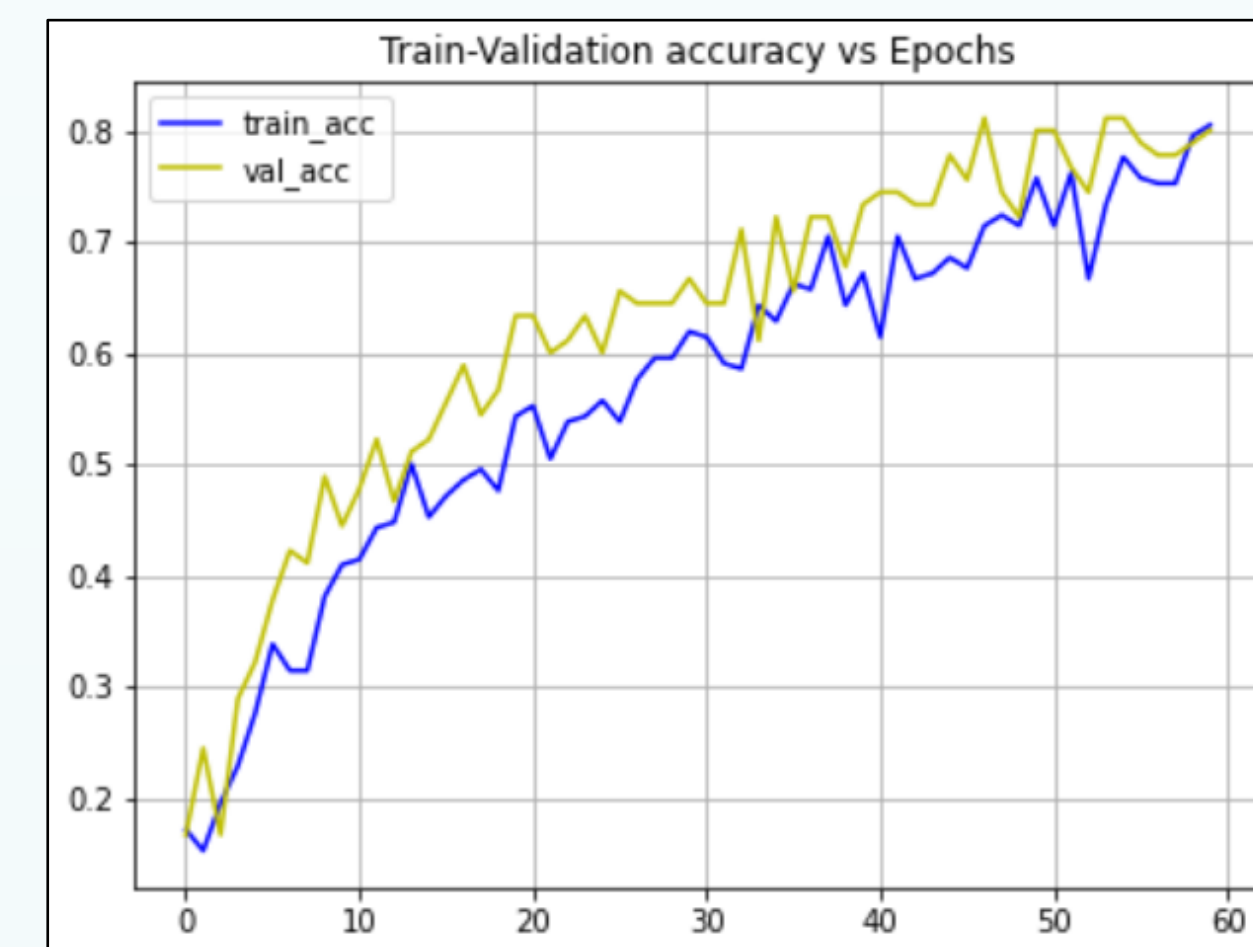
DATASET

- The dataset used in this project consists of number and mathematical symbols scraped from multiple sources.
- The dataset consists of 6 classes of images, with number ranging from 1-4 and mathematical symbols + and x.
- Sample images from some classes are shown below:



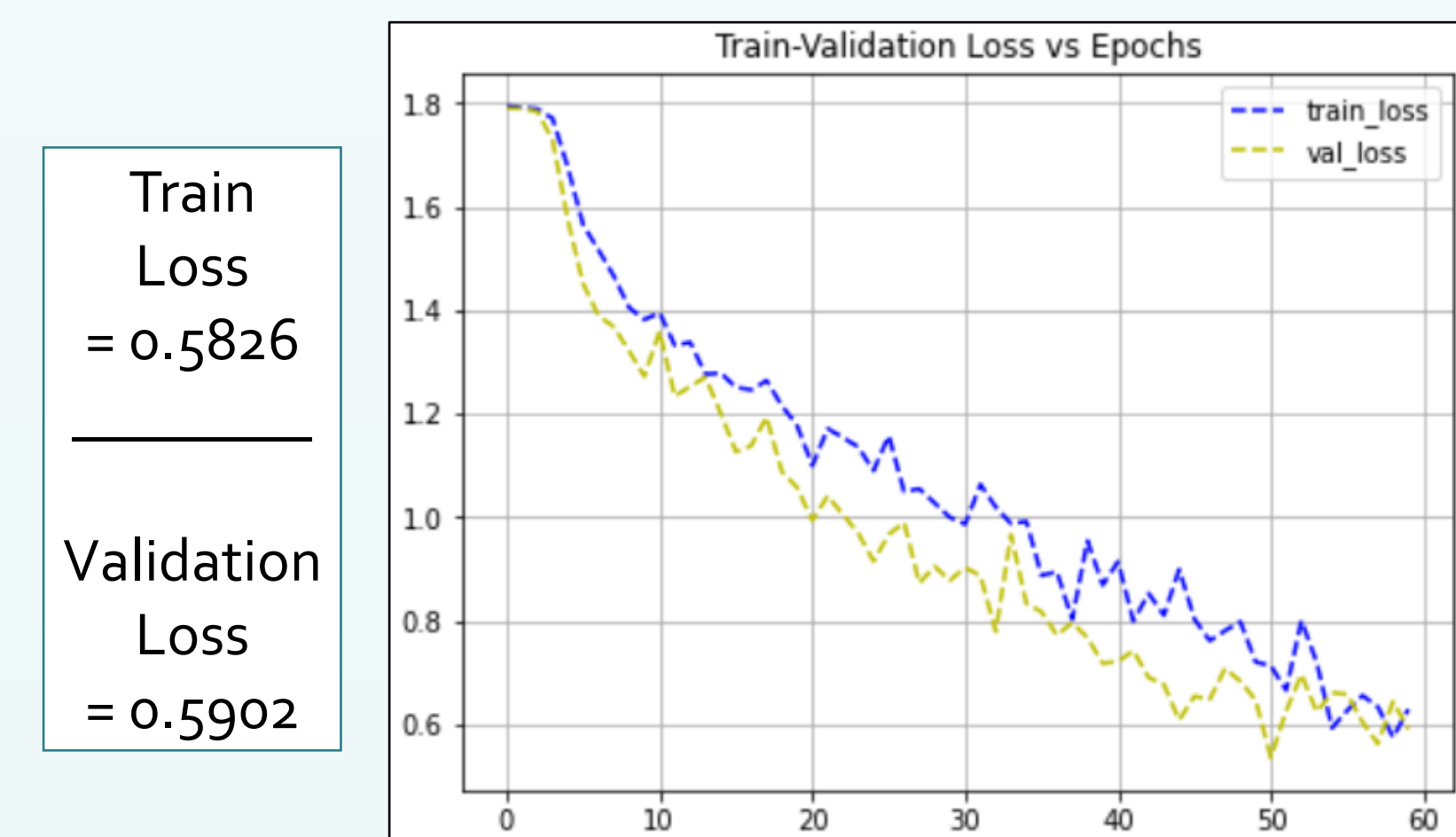
MODEL PERFORMANCE

Model 1:



Train Accuracy = 0.8166

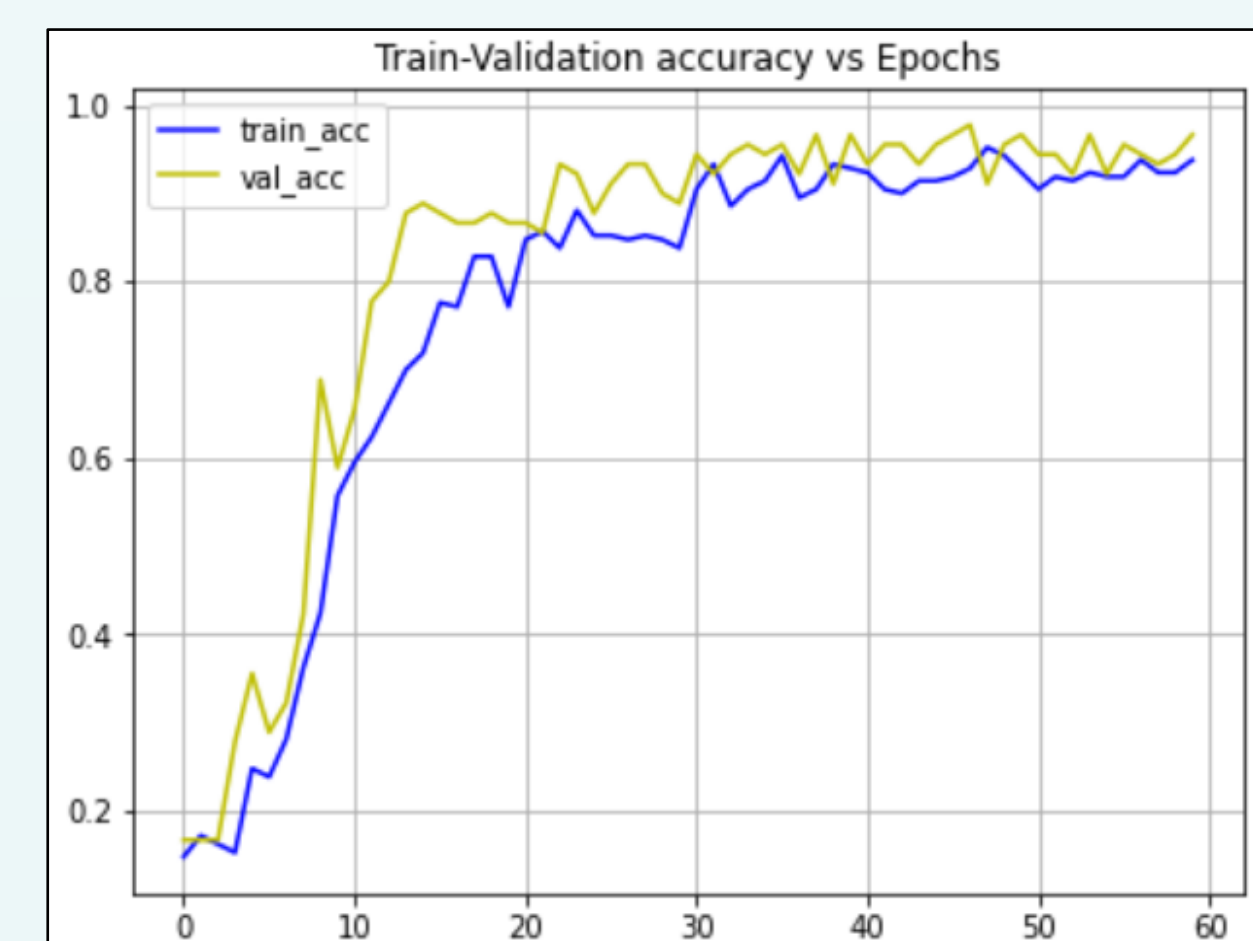
Validation Accuracy = 0.8000



Train Loss = 0.5826

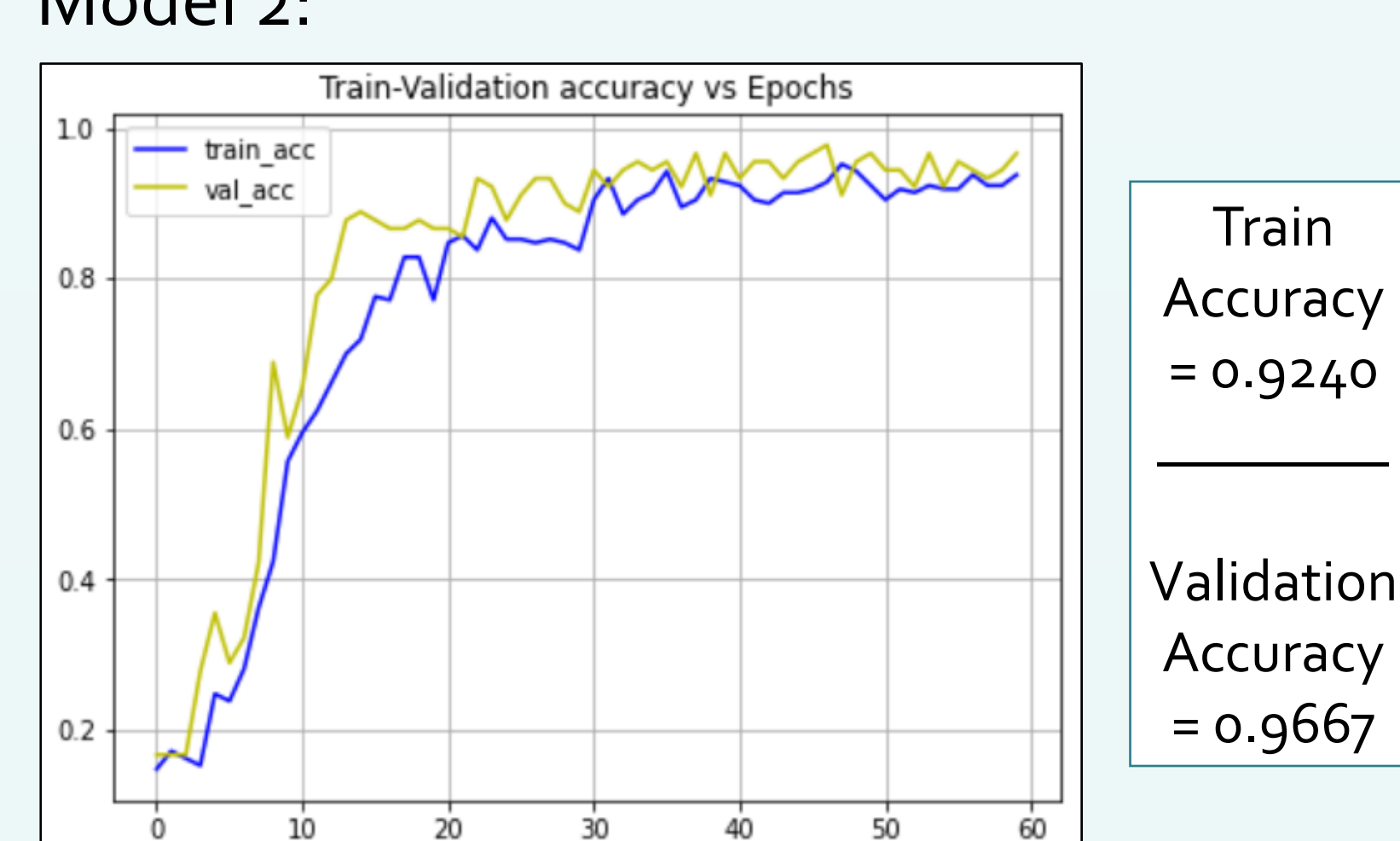
Validation Loss = 0.5902

Model 2:

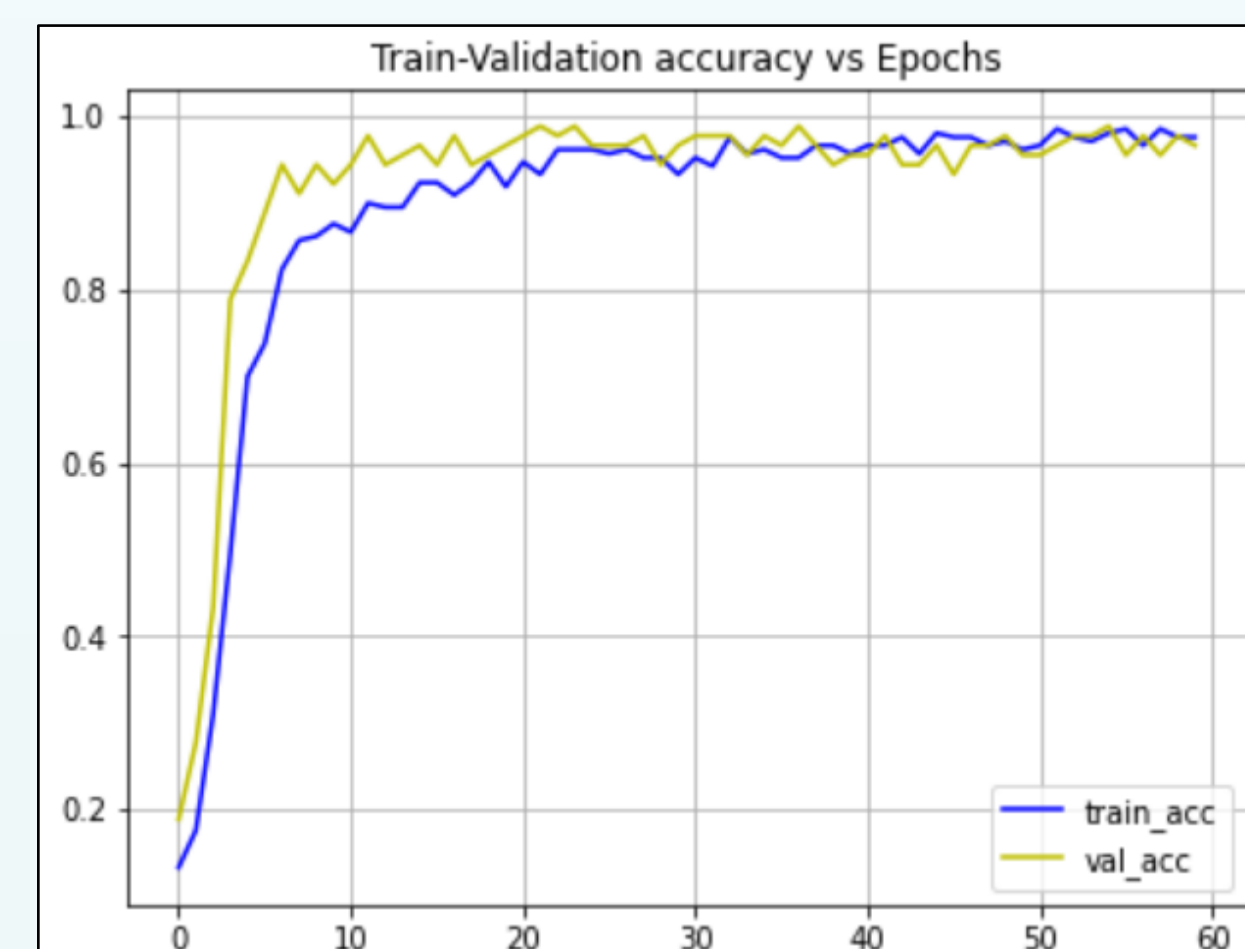


Train Accuracy = 0.9240

Validation Accuracy = 0.9667

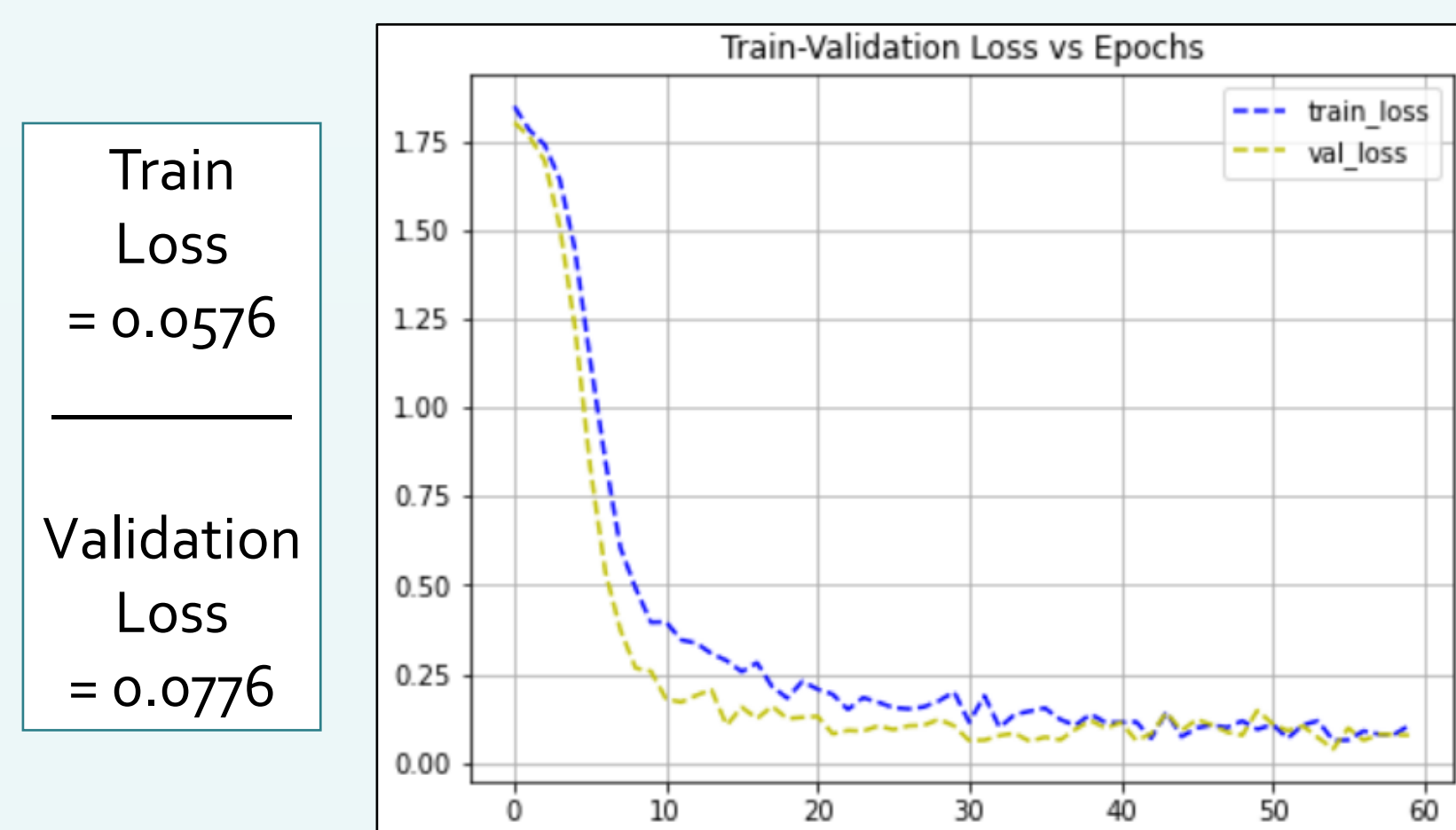


Model 3:



Train Accuracy = 0.9888

Validation Accuracy = 0.9667

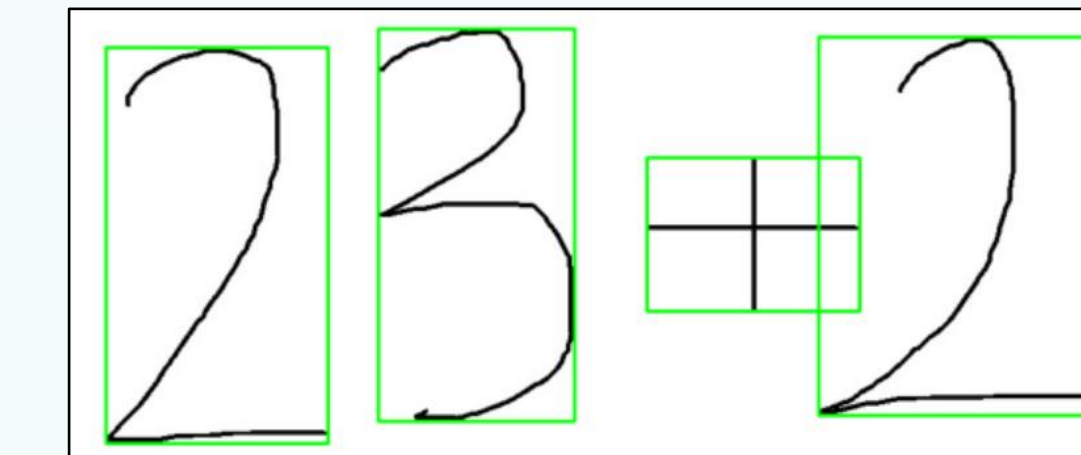


Train Loss = 0.0576

Validation Loss = 0.0776

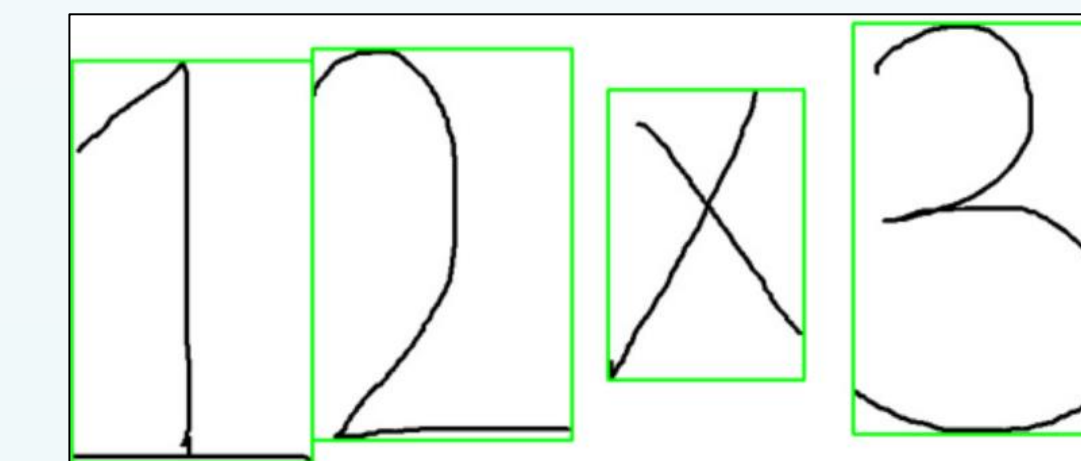
HANDWRITTEN EQUATIONS

Equation 1:



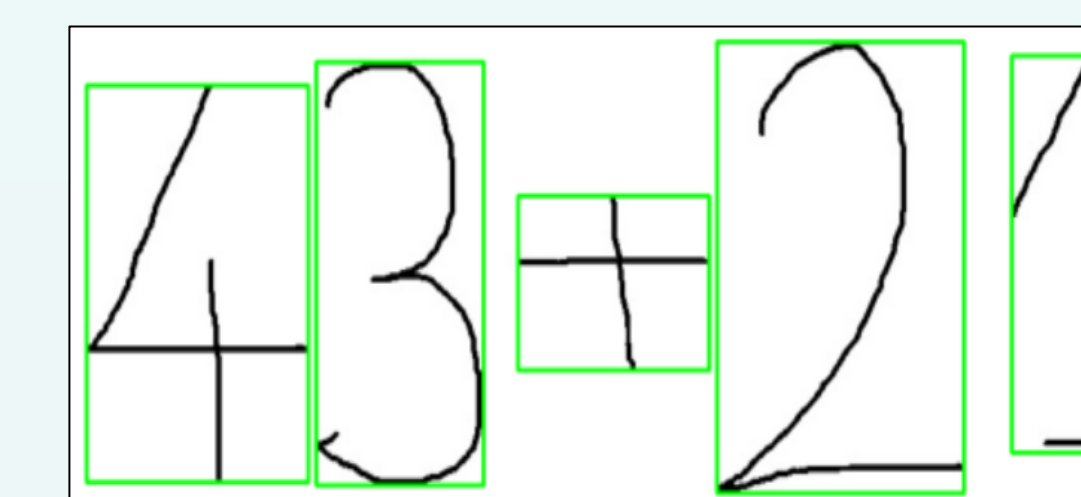
The equation is : 23+2
The solution is : 25

Equation 2:



The equation is : 12*3
The solution is : 36

Equation 3:



The equation is : 43+21
The solution is : 64

CHALLENGES

- Limited number of image classes and training samples.
- Infinite irregularities in handwritten characters.
- Misinterpretation of characters lead to incorrect evaluation.

CONCLUSION

The final model was able to correctly identify and evaluate most of the samples, but on some occasions it failed to identify one or more characters due to the lack of training samples.

REFERENCES

- [1] S. B. K.S., V. Bhat and A. S. Krishnan, "Solvett: An Application for Automated Recognition and Processing of Handwritten Mathematical Equations," 2018 4th International Conference for Convergence in Technology (I2CT), 2018, pp. 1-8, doi: 10.1109/I2CT42659.2018.9058273
- [2] <https://medium.com/@vipul.gupta73921/handwritten-equation-solver-using-convolutional-neural-network-a44accobdgf8>