

# Vudoku - Status Report 01

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## Abstract

The primary objective is to classify and recognize handwritten digits. This research is aimed at understanding the underlying concepts and proofs required for digit recognition. But beyond that it also tries to implement (actually apply) the recently released transformer network [1] to this problem. Further to make this more interactive the project tries to solve a standard Sudoku grid.

## Inspiration

This research project is heavily inspired from [2], which uses CNN for digit recognition.

## Stages and Details

The project can be broadly considered in two stages:

1. Sudoku Recognition
  - (a) Digit Recognition: This module recognizes the handwritten (or otherwise) digits given in the input image or frame of images.
  - (b) Edge Detection: Sudoku is a grid. Edges must be clearly differentiable.
  - (c) Clue Position Inference: To solve some clues are provided at certain locations  $(X, Y)$  in the grid. They need to be correctly identified.
2. Solving Sudoku
  - (a) Prelim Checks: Some condition are to be checked to ensure solvability of a Sudoku grid. Invalid configuration are discarded.
  - (b) Algorithm: To obtain optimized results this could be hybrid approach - including both constrain programming and/or stochastic search.

## Challenges and Expected Outcome

The output is expected as a system which takes an input *image* of standard Sudoku grid and solves it. One of the main challenges would be to perform this with realtime input, like from a camera. The reference project uses Augmented Reality to project solution, but that could take a lot more to learn about.

## Support

Apart from the given references, a lot more of internet has be crawled to gather as much meaningful information from various journals, blogs and articles. Further I've enrolled in a Deep Learning course provided by IIT-M through Swayam/NPTEL, which I believe will be a great help.

## References

- [1] Ashish Vaswani, Noam Shazeer, Niki Parmar, Jakob Uszkoreit, Llion Jones, Aidan N. Gomez, Lukasz Kaiser, and Illia Polosukhin. Attention Is All You Need. *arXiv e-prints*, page arXiv:1706.03762, June 2017.
- [2] Ali Shazly. Sudoku-py. <https://github.com/AliShazly/sudoku-py>, 2019.