Recognizing and solving Sudoku puzzle from image using convolutional neural networks

Introduction

In this project our system takes images of Sudoku puzzles and using convolutional networks recognizes all of the digits inside of the images and their placement. Then our program will propose a solution for the given Sudoku puzzle using backtracking algorithm.

Training

- Training has been done in 30 epochs

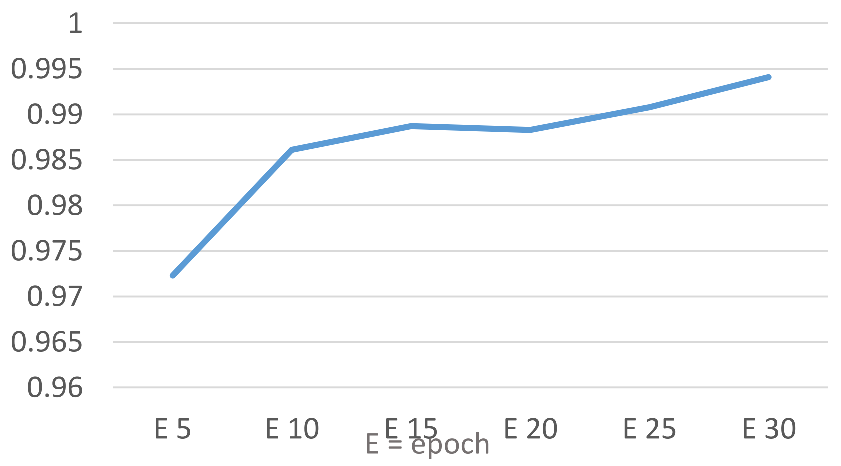
Input

- Input contains 1016 images of each digit (1-9, 9144 in total)
- Images are sized 32x32px
- 80% of the images ae used for training and 20% are used for testing.

Training result

- Accuracy has improved from 0.7437 to 0.9941

Accuracy

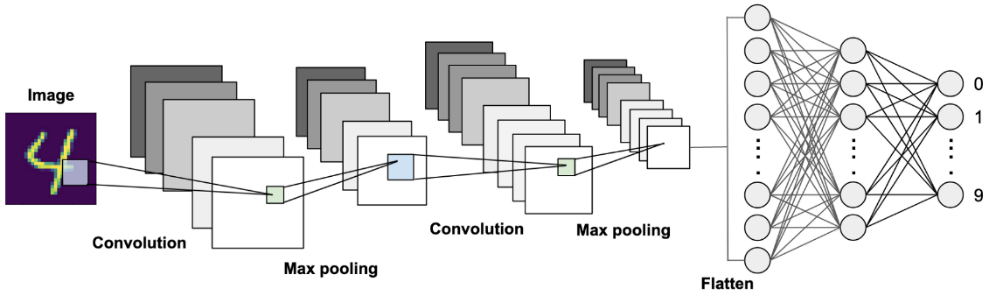


Model

Structure of model (type Sequential):

- 4 convolutional layers activated by ReLu function
- 2 Max pooling layers
- Flattening layer
- Dense layer

First two convolutional layers contain 32 filters, and the second two layers contain 16 filters.



Test data

- The Chars74K dataset - Character Recognition in Natural Images

Dataset used for training and testing our model to be able to recognize digits.

- SUDOKU dataset

Subset of this set is used to demonstrate project solution.

Solution validation

- **py-sudoku** python library for generating and solving sudoku puzzles

Results

Model we have trained is able to recognize and solve the Sudoku puzzle if the image entered to the system is clear. However it is unable to do so if the image is at all blurry. This is the result of the training images provided being also clear.

1								
	2			6	7	8	9	
3				4				
	4			3				
				2	1	6	7	
	6						8	
		7					4	
	8			9	3	7	2	
		9						

Example of the entry into the system

1	9	8	3	5	2	4	6	7
4	2	5	1	6	7	8	9	3
3	7	6	8	4	9	2	1	5
7	4	2	6	3	8	1	5	9
8	5	3	9	2	1	6	7	4
9	6	1	4	7	5	3	8	2
5	3	7	2	1	6	9	4	8
6	8	4	5	9	3	7	2	1
2	1	9	7	8	4	5	3	6

Example of the system output

Disclaimer: This image has been created based on the system output. Our project does not generate images with solution added to them.