

1. A grid of size 5x5 = 25 Cells are used for authentication.

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

2. Devanagari Character set:

Devanagari printed Characters set :

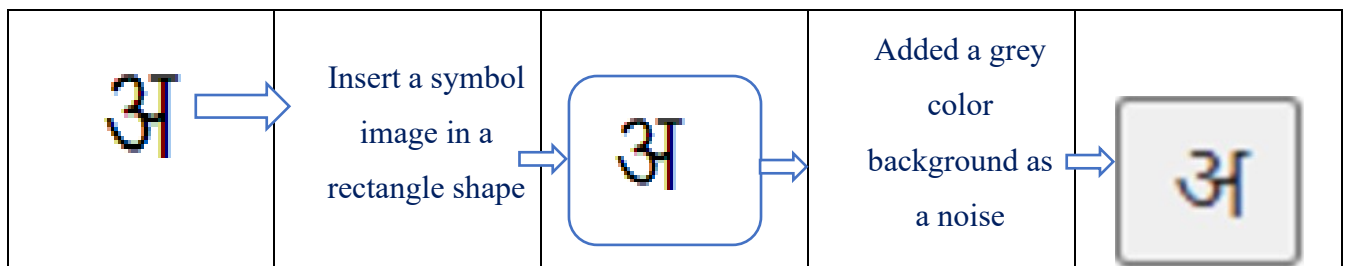
2.1 Image Acquisition: 53 Devanagari printed and handwritten alphabet samples were collected and scanned using a scanner before being converted to a picture format. (.JPG).

2.2 Image Pre-processing:

For printed alphabets following Image preprocessing performed :



- Each printed alphabet's background was converted using Matlab/Python Program
- Image Fusion:** a. Each character enclosed in square.
b. Added a grey color background as a noise



All symbols now in a new format, each image is of a maximum 1 Kilobytes size, a total of 205 kb required to be stored on the server. Each image was renamed with the Unicode number of that character.

2.3 Resizing image :

Handwritten 53 Devanagari alphabets : Each symbol has Size 65 X 65 pixels

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ए	ऐ	ऑ	ओ	ओ	औ	क	ख	ग	घ

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उः	च	छ	ज	झ	ञ	ट	ठ	ड	ढ
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ण	त	थ	द	ध	न	न	प	फ	ब
31.jpg	32.jpg	33.jpg	34.jpg	35.jpg	36.jpg	37.jpg	38.jpg	39.jpg	40.jpg
भ	म	य	र	ऱ	ल	ळ	ळ	व	श
41.jpg	42.jpg	43.jpg	44.jpg	45.jpg	46.jpg	47.jpg	48.jpg	49.jpg	50.jpg
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51.jpg	52.jpg	53.jpg							

3. Design Sub-grid :

In 5 X 5 Grid create 16 sub-grids of 2 X 2 matrices where user can place a Devanagari Symbol.

There are 16 , 2 X 2 matrix = 16 classes

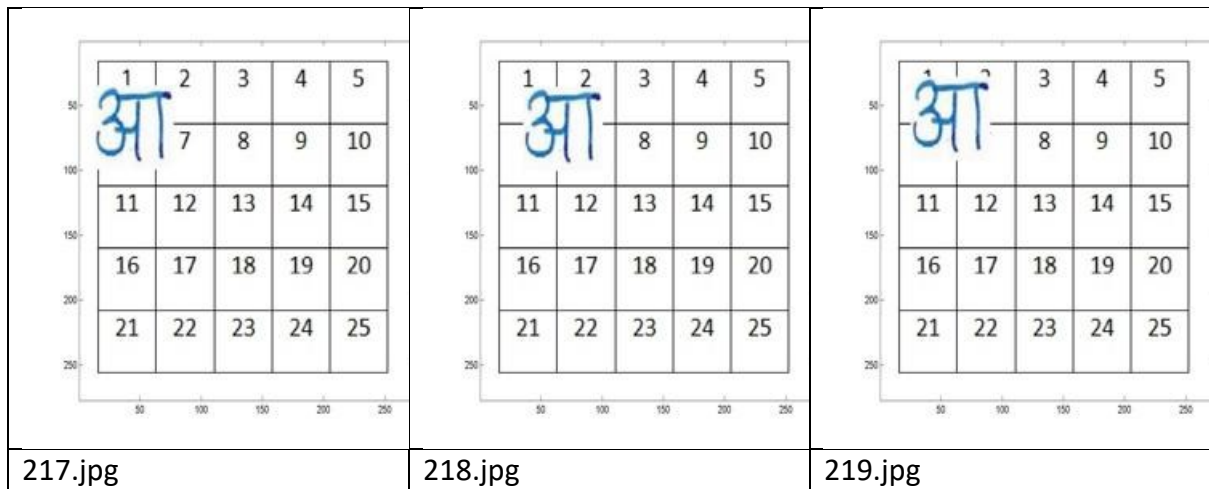
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4. Find location to place a image in sub-grid :

In one 2 X 2 matrix, Place a symbol in 9 (Nine) locations [1. Left top 2. Middle Top 3. Right Top 4. Left Middle 5. Exact Middle 6. Right Middle 7. Left Bottom 8. Middle Bottom 9 . Right Bottom]

		
211.jpg	212.jpg	213.jpg
		
214.jpg	215.jpg	216.jpg



Hardware Requirements:

- Platform: Implemented on Jupyter in the Windows environment
- Language: Python (Version 3.0.0, dated 20th Feb 2020)
- Processor: Intel(R) Core™ i3 or i5, or newer versions
- CPU: @ 2.20 GHz
- RAM: 8 GB GPU
- System Type: 64-bit Windows operating system

Software Requirements:

- Python
- TensorFlow
- Keras

Result :

GRID SIZE 5 x 5	Sixteen 2 X 2 Matrices/ Grid	In each 2 X 2 Matrix 9 Locations

In total there are 53 Handwritten Devanagari Characters Images X 144 locations = 7,632 Devanagari Grid Images Dataset.