OpenCv Perspective Transformation

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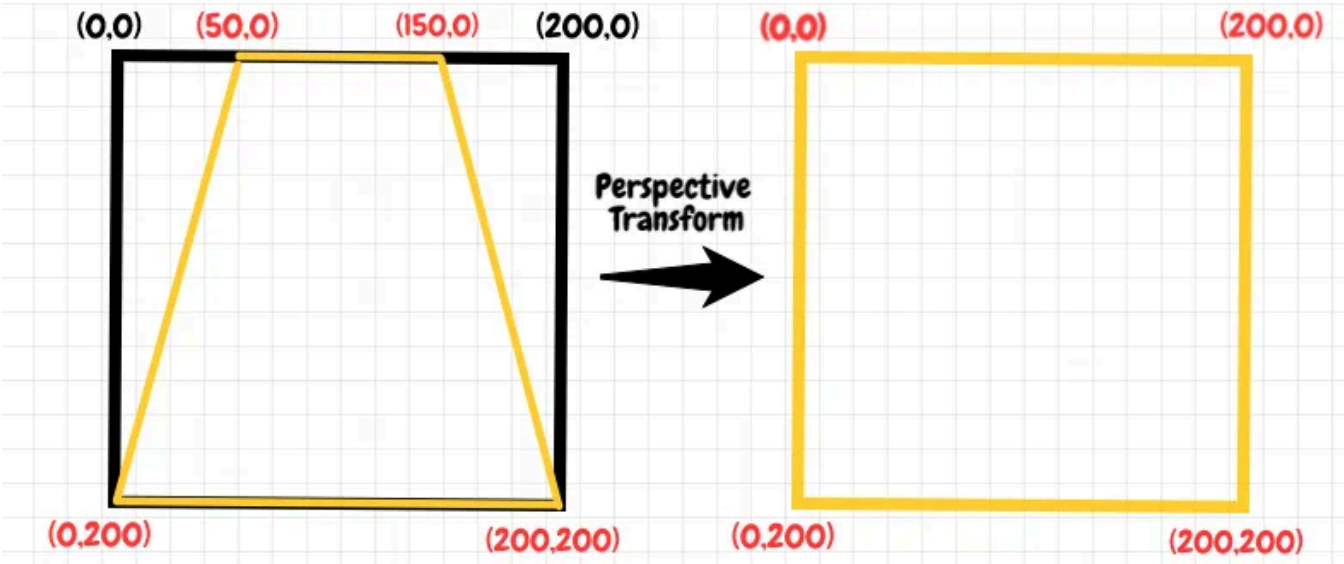
Perspective Transform is a feature that is very useful if you want to align the image properly . It transform the image in a straight manner after Perspective Transformation is applied to it.
A classic Example of this if to transform the page on table to only select the page and transform it so that it appears as a top view of the image

Before we go into OpenCv Perspective Transform function we will look slightly into how the formula,algorithm looks and what goes behind the scene .

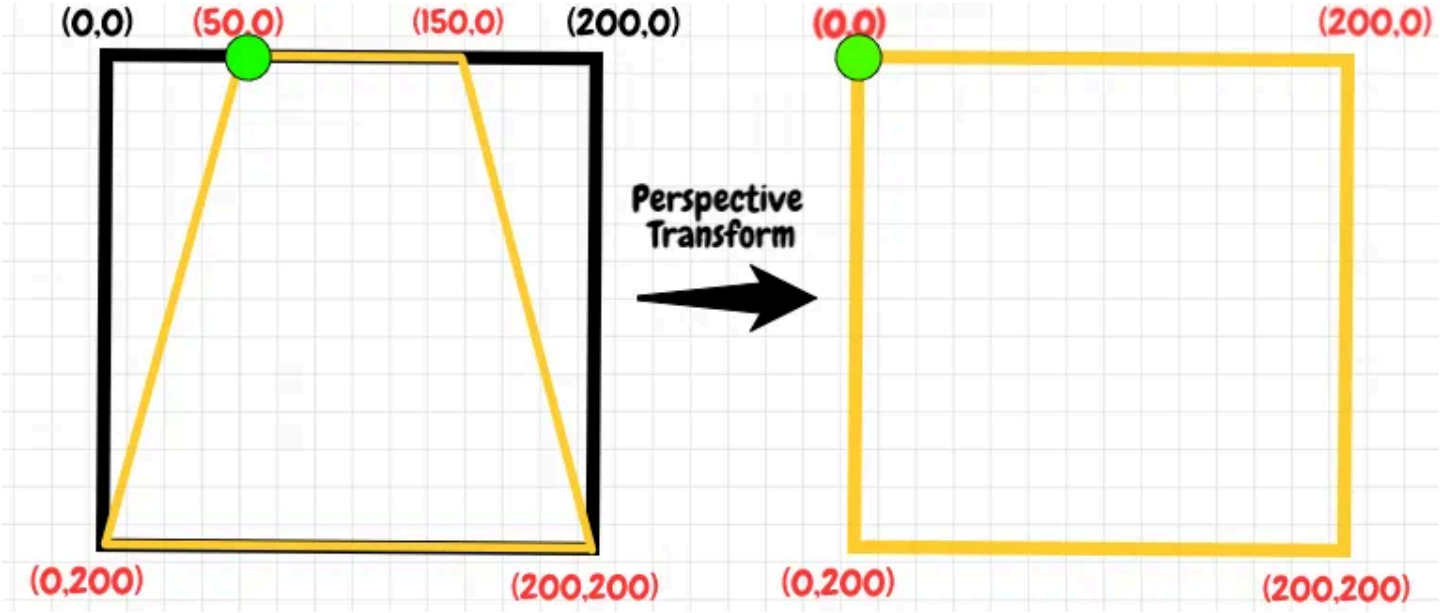


The above image on the left has —
Coordinates [[50,0],[150,0],[0,200],[200,200]]

Which have to be transformed to the new Coordinate —

New Coordinates [[0,0],[200,0],[0,200],[200,200]]

Calculation Example Given Below —



$$Source \quad - \left[[\,50,0\,], [\,150,0\,], [\,200,0\,], [\,200,0\,] \right]$$
$$Destination \; - \left[[\,0,0\,], [\,200,0\,], [\,0,200\,], [\,200,200\,] \right]$$

Transformaton Matrix

(Based on the above Source , Destination Values)

$$\begin{bmatrix} 2 & 0.5 & -100 \\ 0 & 2 & 0 \\ 0 & 0.005 & 1 \end{bmatrix}$$

To Calculate the location of values of each pixel on Destination . Source Pixel values are multiplied with Transformation Matrix as given below .

Step 1 -

Transformation Martix is multiplied with Pixel x,y cordinate values .

$$\begin{bmatrix} 2 & 0.5 & -100 \\ 0 & 2 & 0 \\ 0 & 0.005 & 1 \end{bmatrix} . \begin{bmatrix} 50 \\ 0 \\ 1 \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$$

Step 2 -

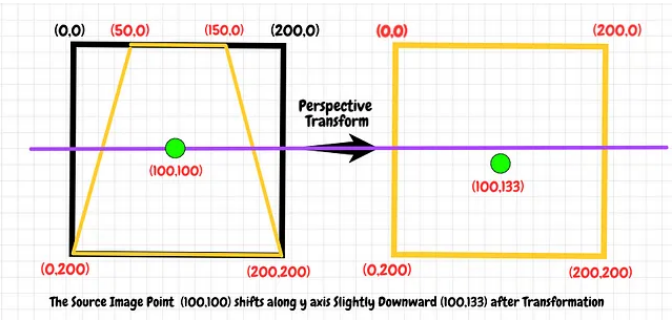
Values obtiaind of first two rows are divides by third row to obtain (x,y) as given below.

$$[\,0/1, 0/1\,] \; = \; [\,0,0\,]$$

There for source to Destination Pixel location would be as Below

$$Source\,[\,50,0\,] \; = \; Destination\,[\,0,0\,]$$

Below is second calculation example



To Calculate the location of values of each pixel on Destination . Source Pixel values are multiplied with Transformation Matrix as given below .

Step 1 -

Transformation Martix is multiplied with Pixel x,y cordinate values .

$$\begin{bmatrix} 2 & 0.5 & -100 \\ 0 & 2 & 0 \\ 0 & 0.005 & 1 \end{bmatrix} . \begin{bmatrix} 100 \\ 100 \\ 1 \end{bmatrix} = \begin{bmatrix} 150 \\ 200 \\ 1.5 \end{bmatrix}$$

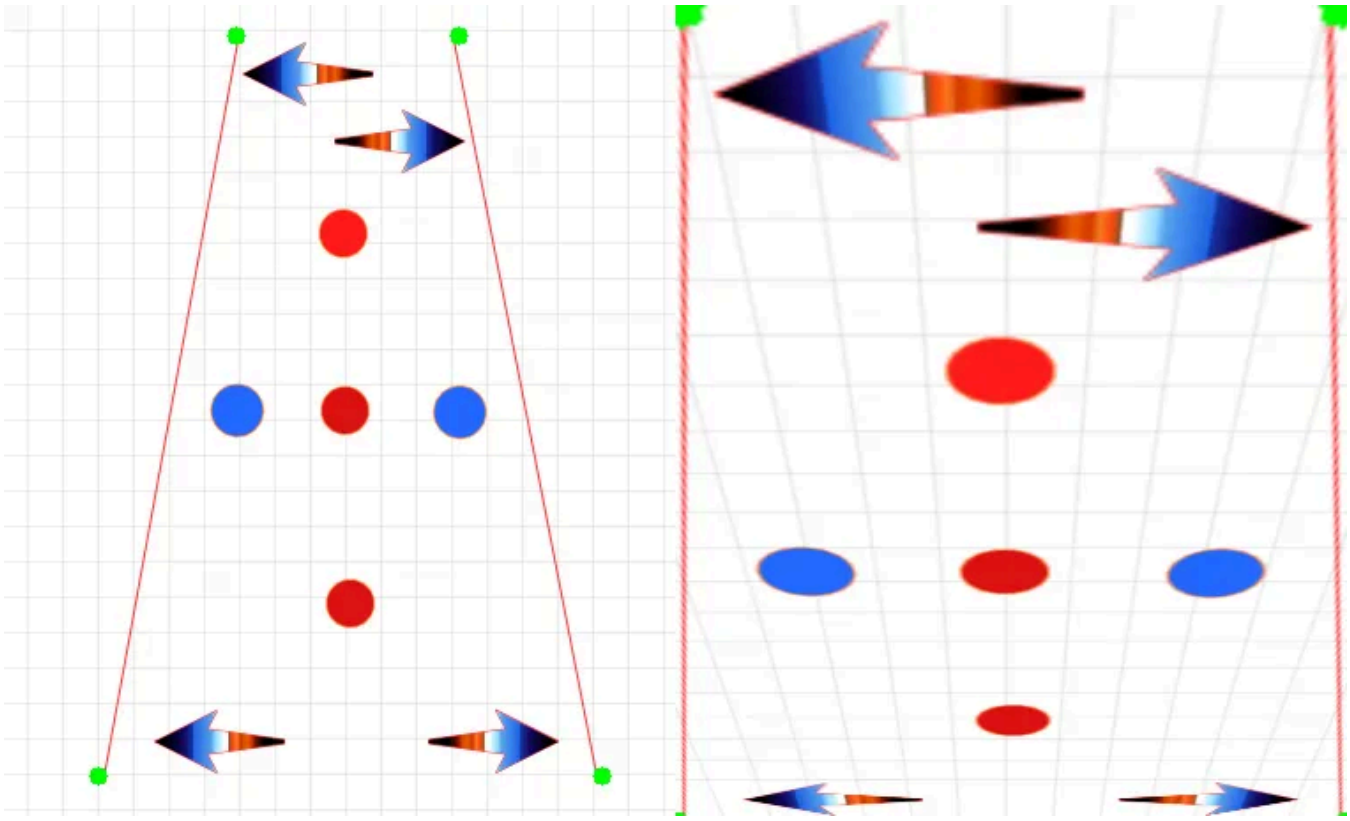
Step 2 -

Values obtiaind of first two rows are divides by third row to obtain (x,y) as given below.

$$[\,150/1.5, 200/1.5\,] = [\,100, 133.33\,]$$

There for source to Destination Pixel location would be as Below

$$Source\,[\,100, 100\,] = Destination\,[\,100, 133.33\,]$$

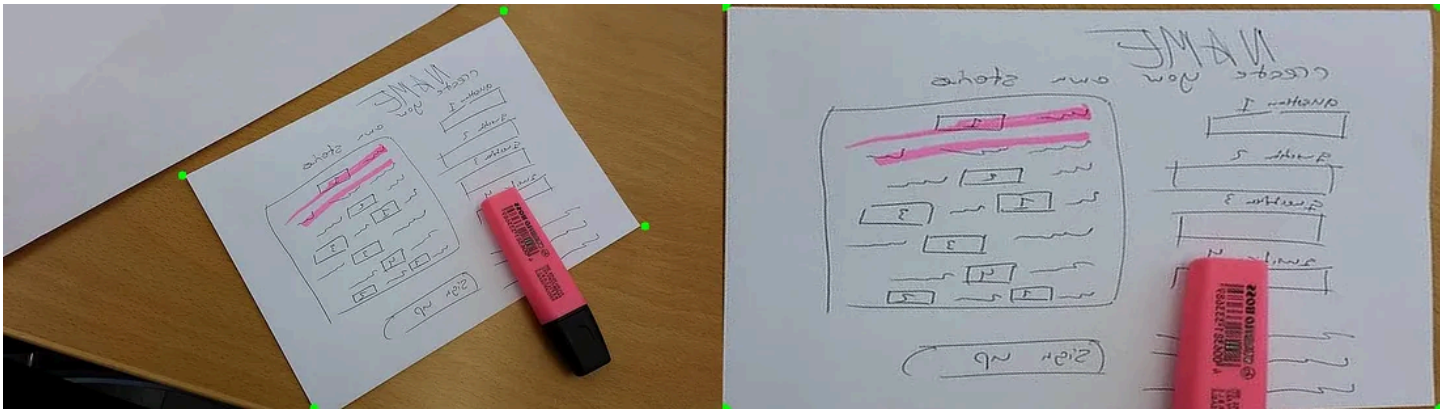


As you can see from the image all the horizontal Parallel lines are kept Parallel after transformation . Vertical Parallel lines are not Parallel to each other after Transformation .

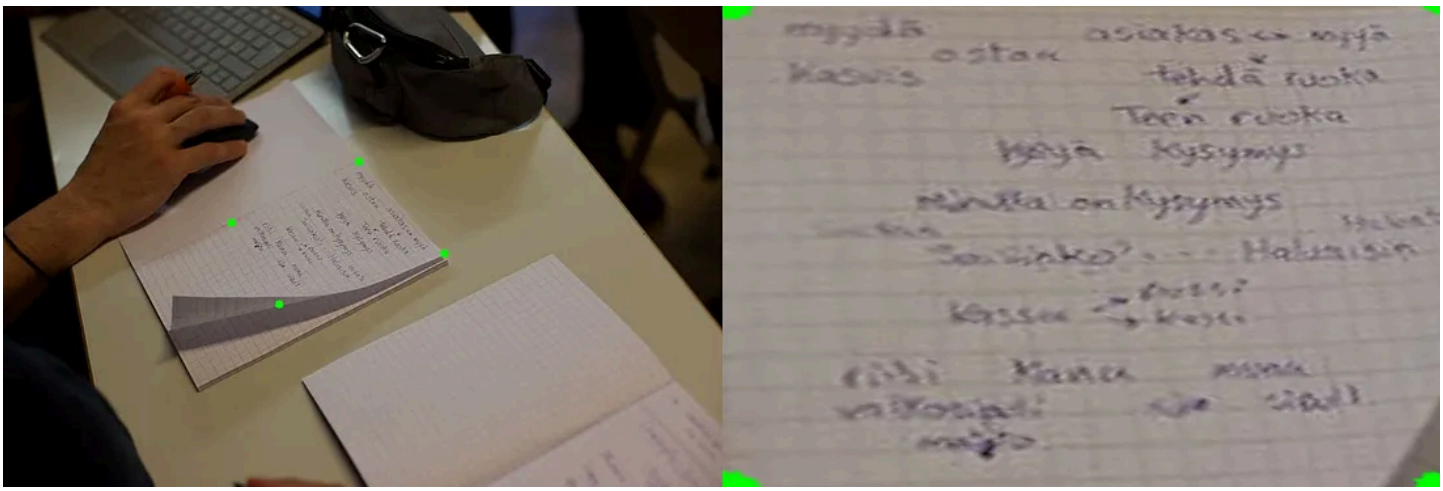
Implementation of Perspective Transformation in OpenCv

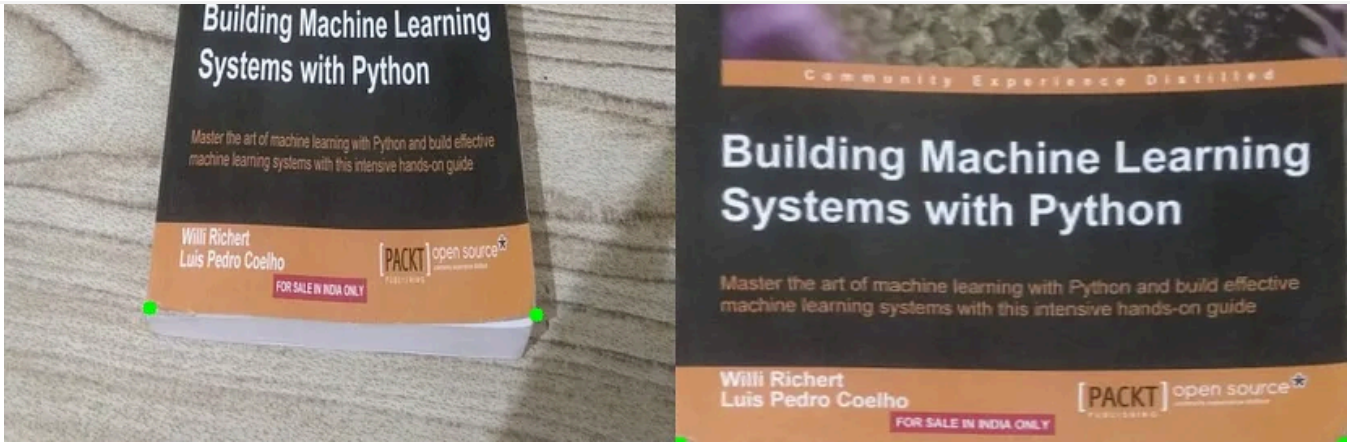
```
import cv2
from operator import itemgetter
from glob import glob
import matplotlib.pyplot as plt
```

```
paper = cv2.imread('./Photos/book.jpg')
# Coordinates that you want to Perspective Transform
pts1 = np.float32([[219,209],[612,8],[380,493],[785,271]])
# Size of the Transformed Image
pts2 = np.float32([[0,0],[500,0],[0,400],[500,400]])
for val in pt1:
    cv2.circle(paper,(val[0],val[1]),5,(0,255,0),-1)
M = cv2.getPerspectiveTransform(pt1,pts2)
dst = cv2.warpPerspective(paper,M,(500,400))
plt.imshow(dst)
```



As you can see from the above image how the Perspective Transform function maintains the Horizontal lines in the image and manages to get the top view for the paper . Some more example images given below





Reference —
https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_geometric_transformations/py_geometric_transformations.html
http://jlouthan.github.io/perspective-transform/examples/test-ui/index.html

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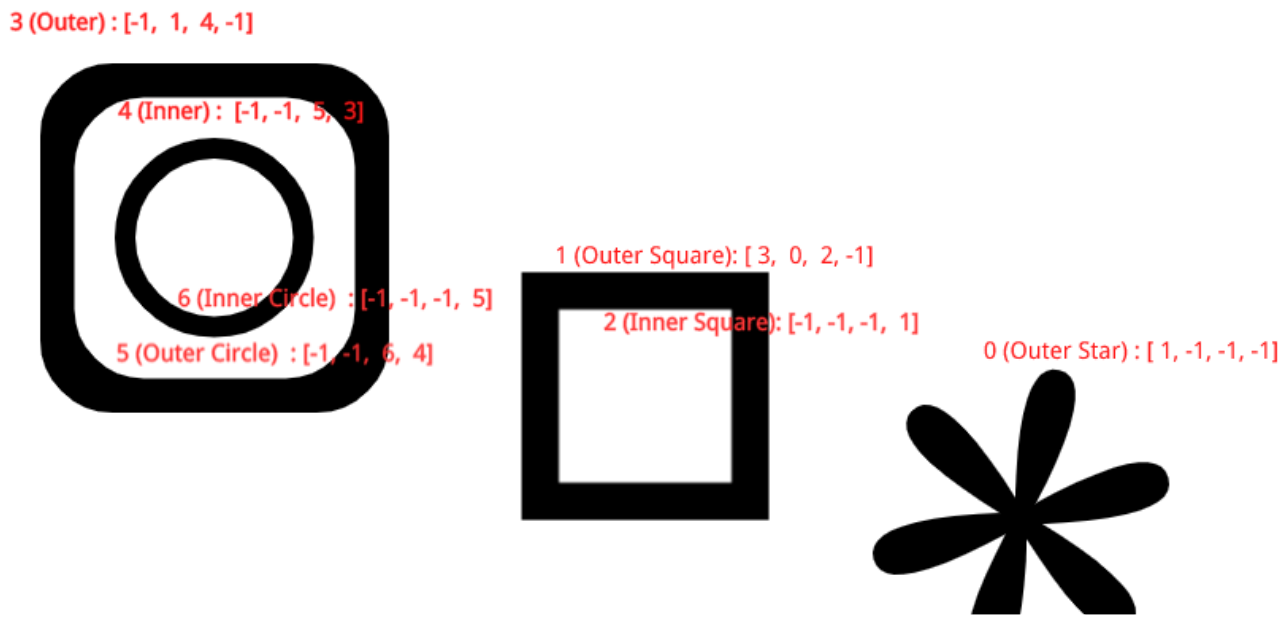

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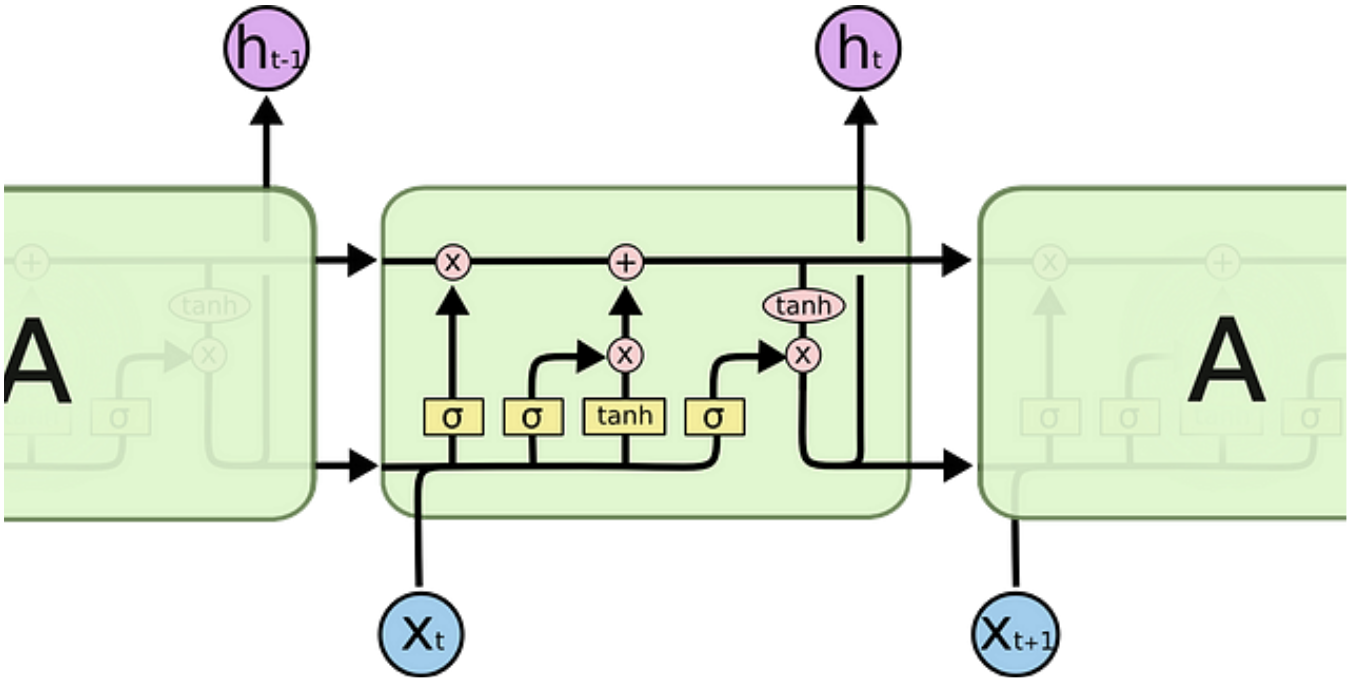

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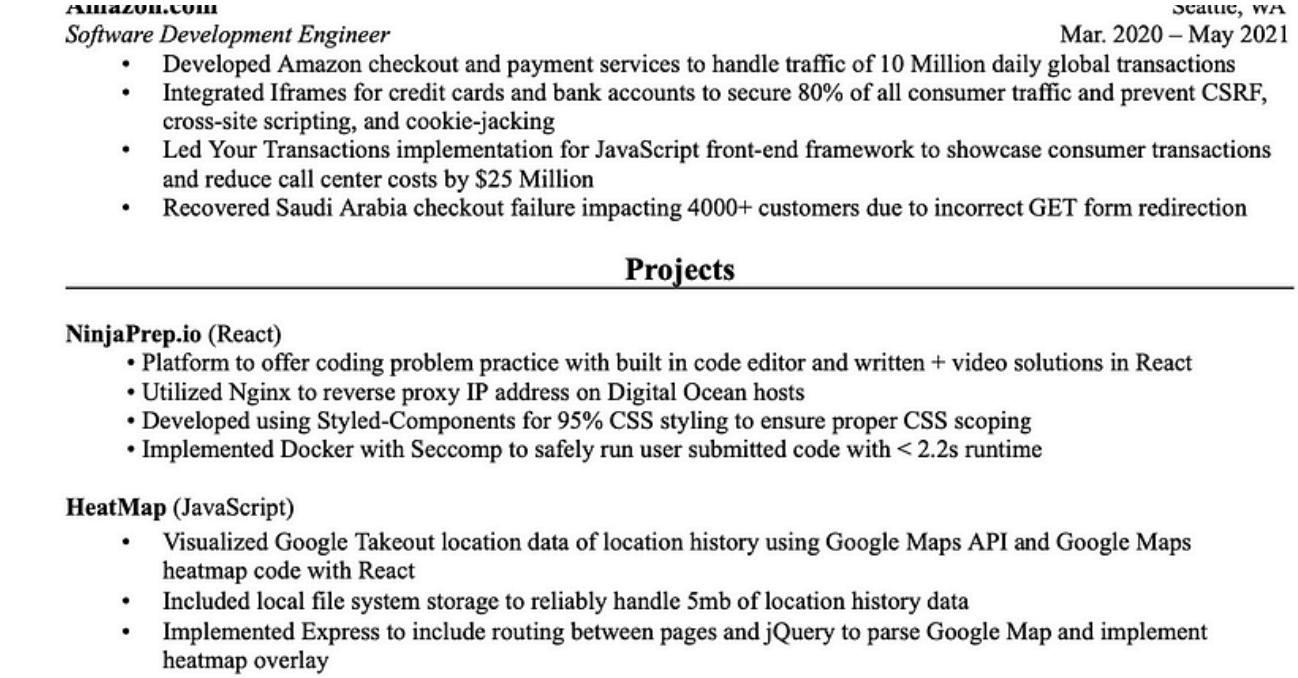

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Software Development Engineer Mar. 2020 – May 2021

- Developed Amazon checkout and payment services to handle traffic of 10 Million daily global transactions
- Integrated Iframes for credit cards and bank accounts to secure 80% of all consumer traffic and prevent CSRF, cross-site scripting, and cookie-jacking
- Led Your Transactions implementation for JavaScript front-end framework to showcase consumer transactions and reduce call center costs by $25 Million
- Recovered Saudi Arabia checkout failure impacting 4000+ customers due to incorrect GET form redirection

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- Platform to offer coding problem practice with built in code editor and written + video solutions in React
- Utilized Nginx to reverse proxy IP address on Digital Ocean hosts
- Developed using Styled-Components for 95% CSS styling to ensure proper CSS scoping
- Implemented Docker with Seccomp to safely run user submitted code with < 2.2s runtime

HeatMap (JavaScript)
- Visualized Google Takeout location data of location history using Google Maps API and Google Maps heatmap code with React
- Included local file system storage to reliably handle 5mb of location history data
- Implemented Express to include routing between pages and jQuery to parse Google Map and implement heatmap overlay

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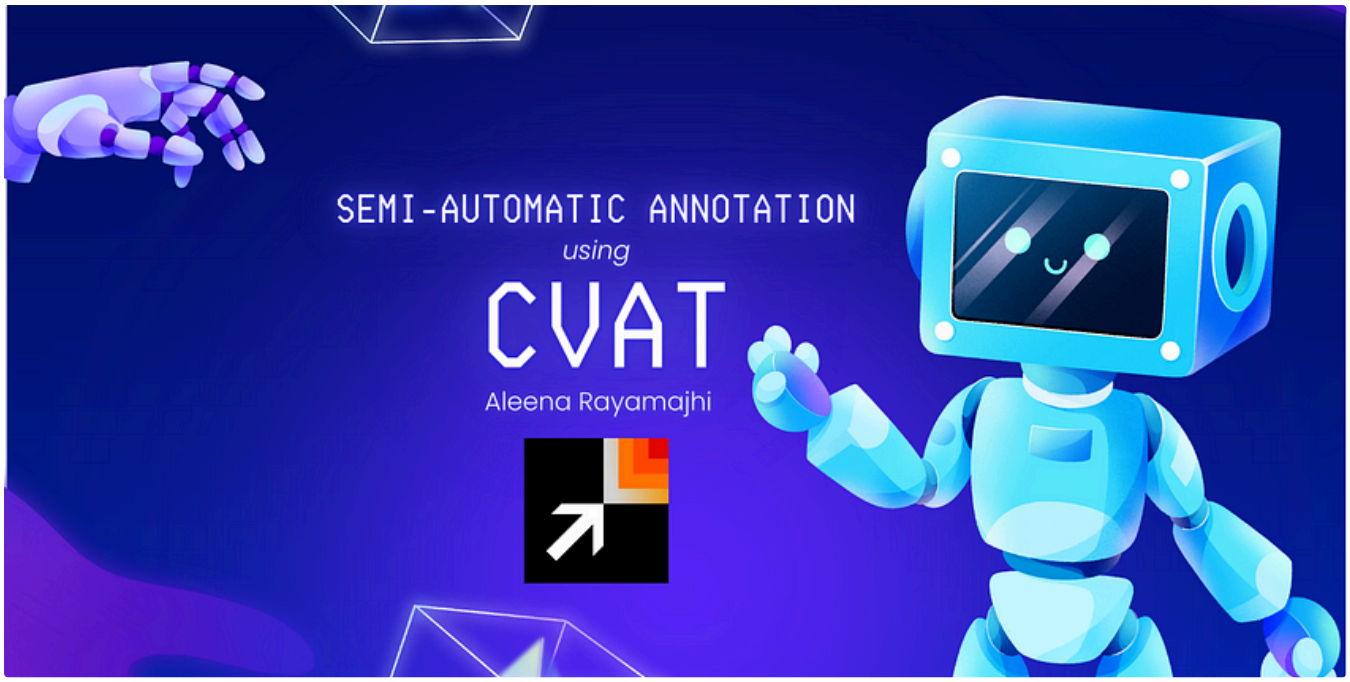

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No more manual ANNOTATIONS!

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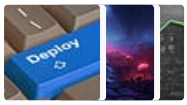

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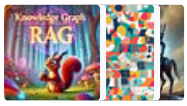

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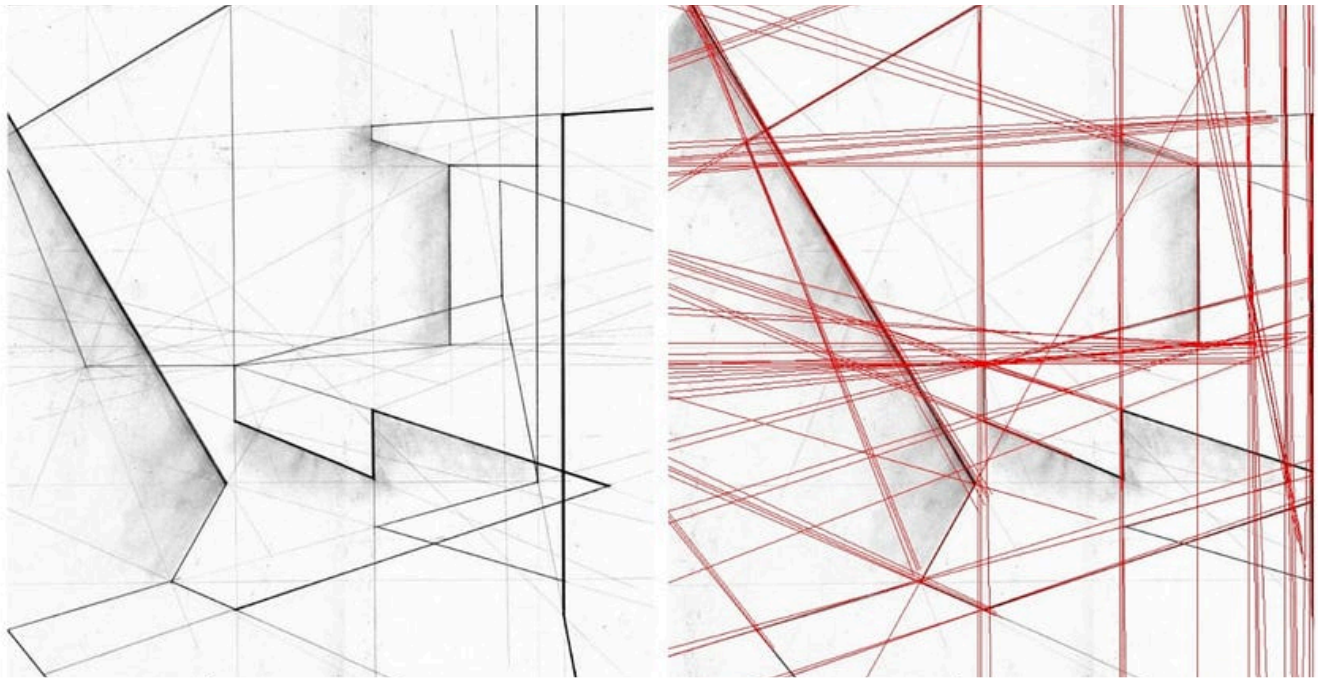

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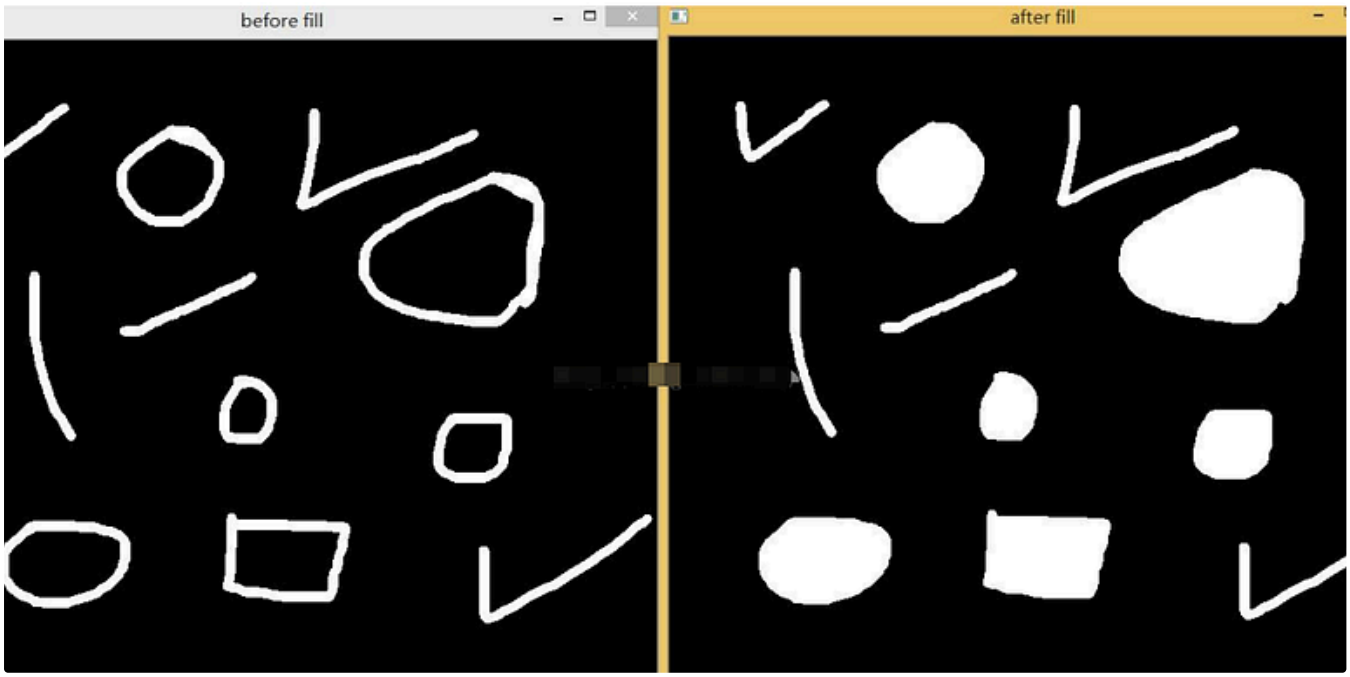

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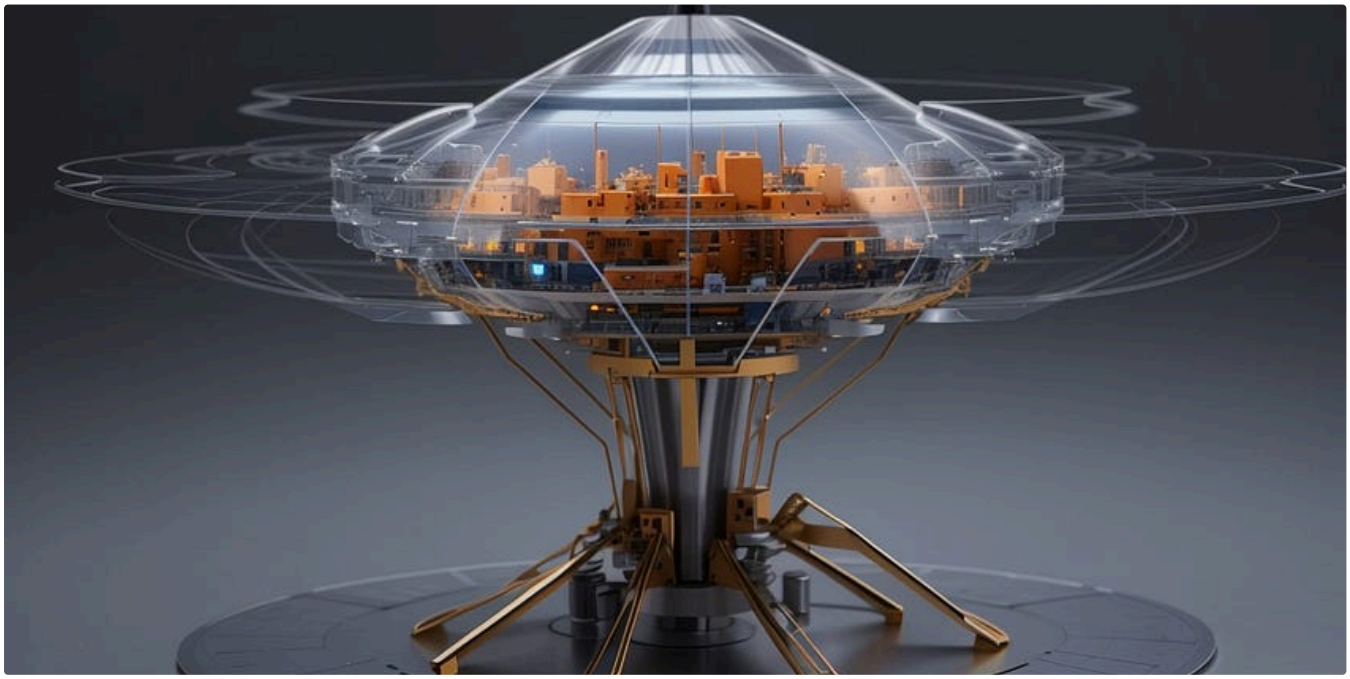

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