

# CS445 - Final Project

Karan Gupta | karang3@illinois.edu

## Real Bookshelf to Virtual Bookshelf

The idea is to take an image of a real life bookshelf and generate a digital list of books, along with a Goodreads link for each of them.

```
In [1]: import cv2
import ipywidgets as widgets
from matplotlib import pyplot as plt
%matplotlib inline
import numpy as np
%load_ext autoreload
%autoreload 1
%aimport utils
%aimport east
%aimport segment
```

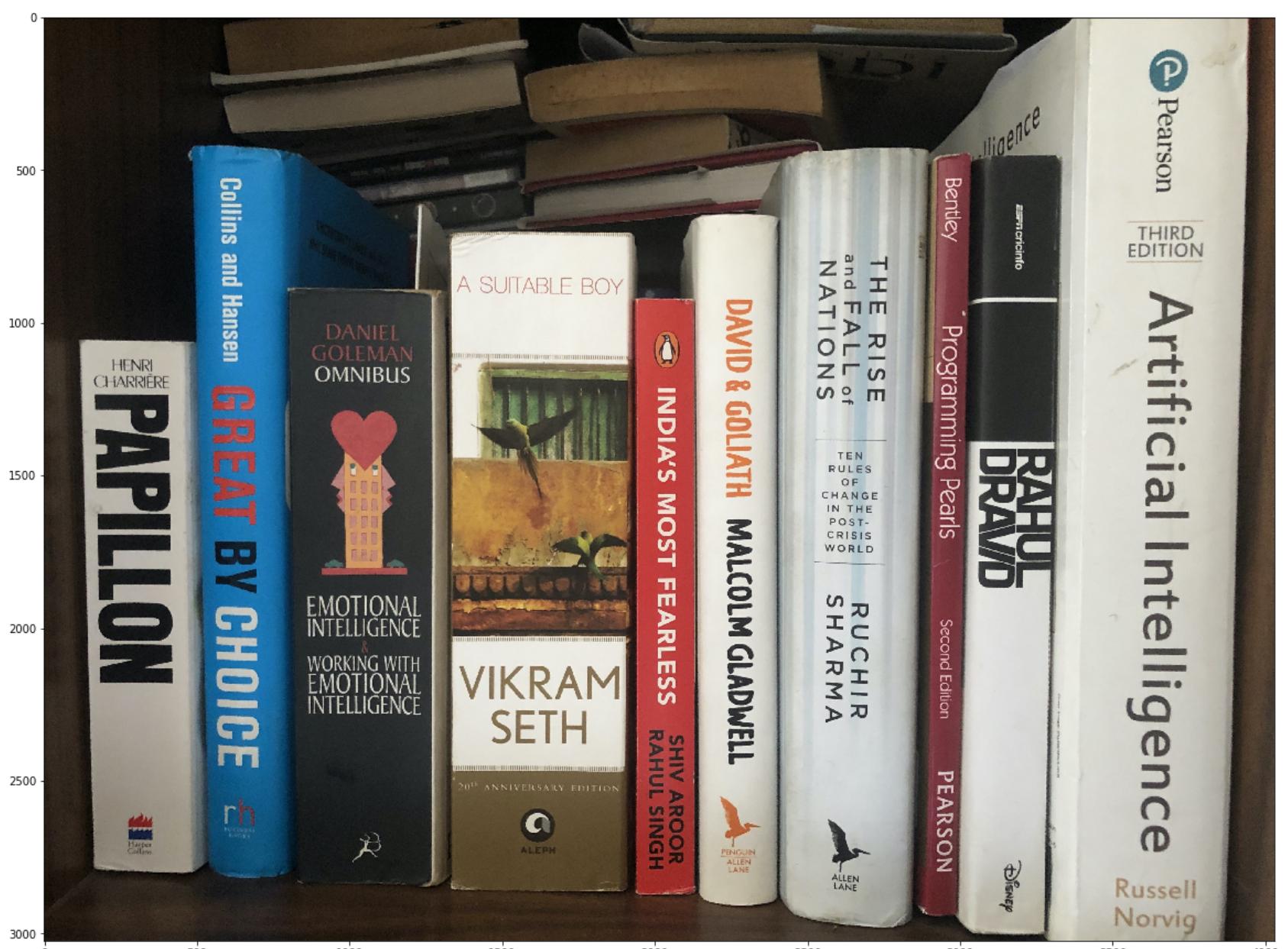
```
In [2]: cv2.__version__
```

```
Out[2]: '4.1.1'
```

## Upload an image

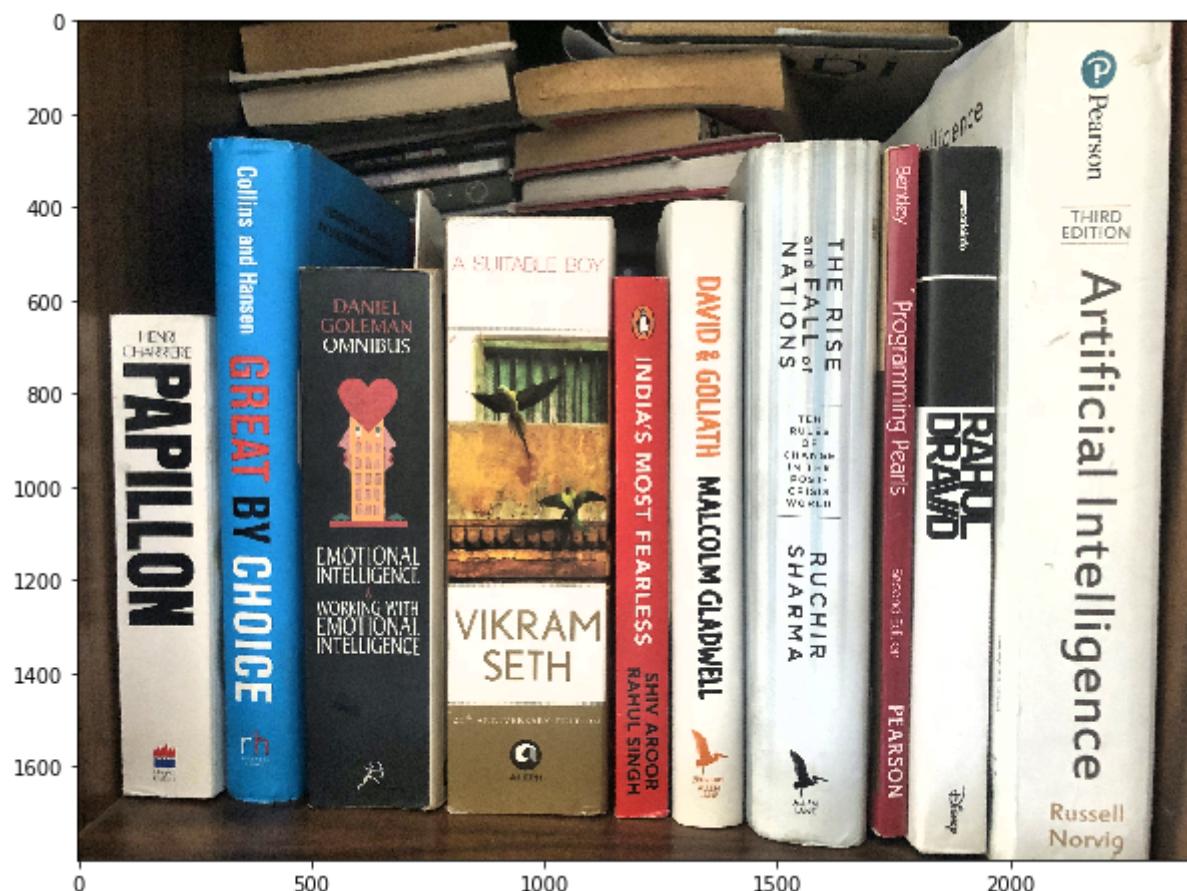
```
In [3]: # Read the image
img = cv2.imread("images/bookshelf3b.jpeg")
#img = cv2.imread("images/bookshelf3a.jpeg")
height, width = img.shape[:2]
print(height,width)
utils.showImage(img,size=20)
```

3024 4032



## Pre-process the image

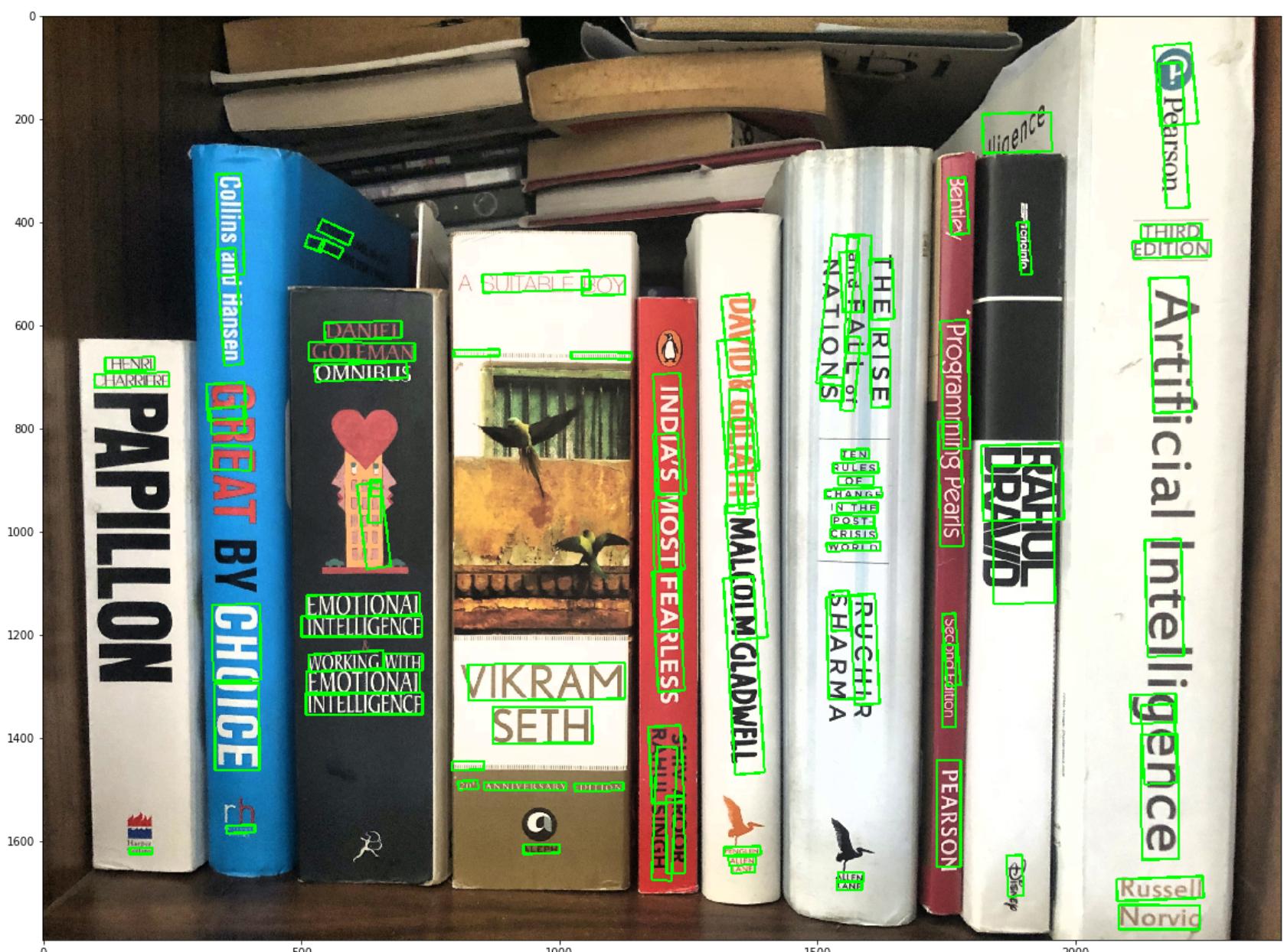
```
In [4]: im_eq = utils.imgPreprocess(img)
utils.showImage(im_eq)
```



## Run Text Detection on the Image

```
In [5]: frame, framev, boxes, indices = east.detectText(im_eq,0.5,0.3)
```

```
In [6]: utils.showImage(framev,size=20)
```



## Use bounding boxes to separate out the books

Check how the whole bounding boxes thing works

```
In [7]: indices[1]
```

```
Out[7]: array([2680], dtype=int32)
```

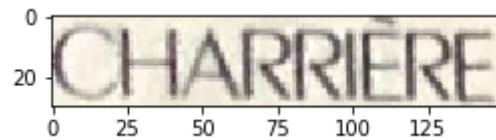
```
In [8]: boxes[indices[1][0]]
```

```
Out[8]: ((172.7839248920397, 707.4870865221203),
(144.1421, 26.723934),
-0.9647642202643011)
```

```
In [9]: cv2.boxPoints(boxes[indices[1][0]])
```

```
Out[9]: array([[100.94806, 722.0606 ],
[100.49811, 695.3405 ],
[244.61978, 692.9135 ],
[245.06973, 719.6336 ]], dtype=float32)
```

```
In [10]: startX,endX,startY,endY = segment.getBBox(boxes[indices[1][0]],2)
utils.showImage(frame[startY:endY,startX:endX],size=4)
```



## Sort boxes based on min(x) and min(y)

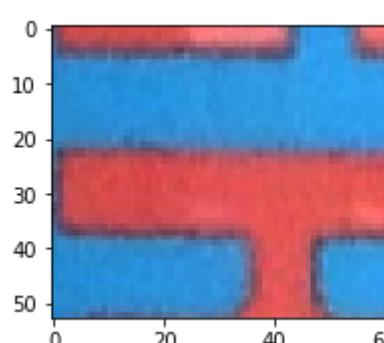
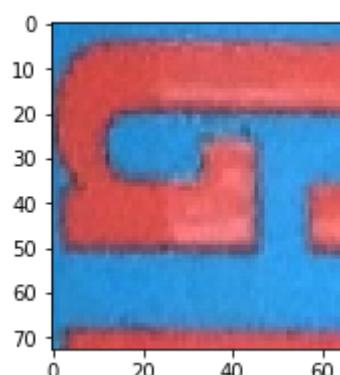
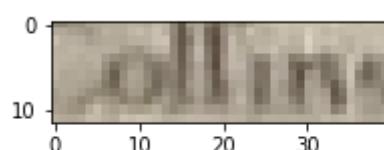
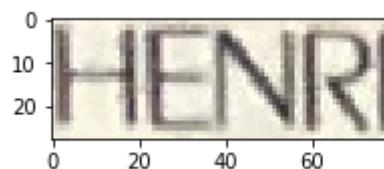
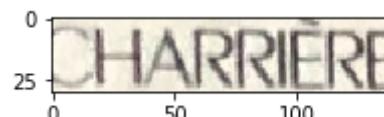
```
In [11]: sboxes = segment.getSortedBoxes(boxes,indices,0.05)
```

## Trim the start X and end X for each box

This is done to eliminate unnecessary borders from bounding boxes

```
In [12]: sboxes = segment.trimBoxes(frame,sboxes)
```

```
In [13]: # Display some of the snippets using bounding boxes
for b in sboxes[:5]:
    utils.showImage(frame[
        b["minY":b["maxY"],
        b["minX":b["maxX"]]
    ],size=3)
```



## Separate out the boxes into different books

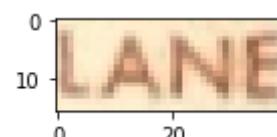
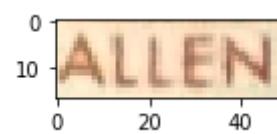
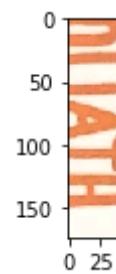
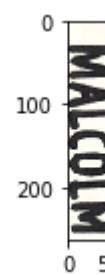
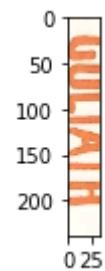
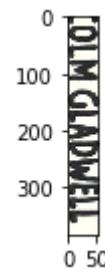
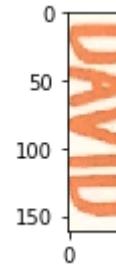
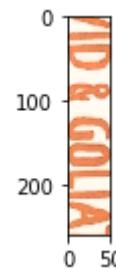
We go through the sorted boxes in order and use a heuristic to segregate them into separate books

```
In [14]: bookList = segment.boxesToBooks(sboxes, debug=True)
len(bookList)
```

```
current minX, maxX for book: 327 241
New Book
current minX, maxX for book: 519 419
New Book
current minX, maxX for book: 801 732
New Book
current minX, maxX for book: 1175 1139
New Book
current minX, maxX for book: 1330 1243
New Book
current minX, maxX for book: 1507 1387
New Book
current minX, maxX for book: 1736 1646
New Book
current minX, maxX for book: 1833 1796
New Book
current minX, maxX for book: 2090 1974
New Book
```

```
Out[14]: 10
```

```
In [15]: # Print images from one of the books
bookIdx= 5
for b in bookList[bookIdx][ "boxes" ]:
    utils.showImage(frame[ b[ "minY" ]:b[ "maxY" ], b[ "minX" ]:b[ "maxX" ] ],size=2)
```

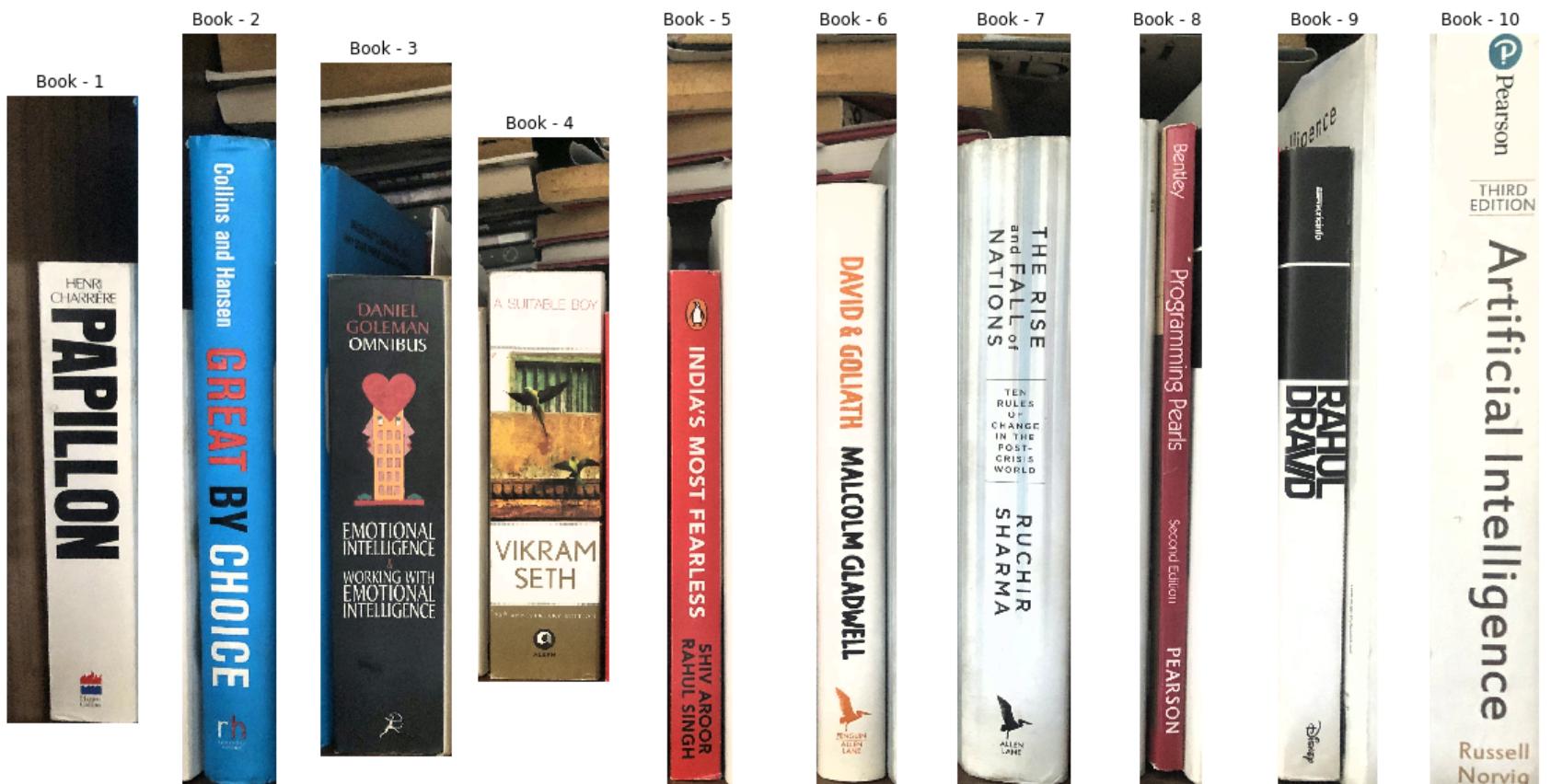


## Create image block for each book

```
In [16]: bookImages = segment.getBookImages(frame,bookList,pady=frame.shape[0])
```

## Show all segmented books

In [17]: `segment.showSegmentedBooks(bookImages)`



In [18]: `# Dump all image blocks to the disk  
import os`

```
folder = 'images/books_slices'  
if not os.path.exists(folder):  
    os.makedirs(folder)  
  
for i, bk in enumerate(bookImages):  
    plt.imsave("{}/book_{:02d}.jpg".format(folder,i),\n               cv2.cvtColor(bk, cv2.COLOR_BGR2RGB))
```

## Do OCR on the extracted images

We will be using [Google Vision API \(<https://cloud.google.com/vision/docs/ocr>\)](https://cloud.google.com/vision/docs/ocr) to do the OCR, as pytesseract is simply not working for text with varying background. I tried to make it work with some preprocessing but just couldn't get the desired result.

In [19]: `# Tesseract is simply not working, even with a lot of image preprocessing  
#  
# import pytesseract  
# for i, bk in enumerate(bookImages):  
# print("\nBook: ",i)  
# print(pytesseract.image_to_string(np.rot90(bk)))`

In [20]: `%aimport gocr`

```
In [21]: booksInfo = gocr.getAllBookLinks(bookImages)
booksInfo
```

```
Out[21]: [ {'query': 'Harper\nPAPILLON\n',
  'title': 'Papillon (Harper Perennial Modern Classics)',
  'author': 'Henri Charrière',
  'google_link': 'https://play.google.com/store/books/details?id=d9evJVGHU7UC&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=Papillon+(Harper+Perennial+Modern+Classics)+Henri+Charri%C3%A8re&search_type=books&search%5Bfield%5D=on'},
  {'query': 'GREAT BY CHOICE\nCollins and Hansen\n',
  'title': 'Great by Choice',
  'author': 'Jim Collins',
  'google_link': 'https://play.google.com/store/books/details?id=mQrNwkQkeGEC&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=Great+by+Choice+Jim+Collins&search_type=books&search%5Bfield%5D=on'},
  {'query': 'DANIEL\nGOLEMAN\nOMNIBUS\nEMOTIONAL\nINTELLIGENCE\nWORKING WITH\nEMOTIONAL\nINTELLIGENCE\n',
  'title': 'Working with Emotional Intelligence',
  'author': 'Daniel Goleman',
  'google_link': 'https://play.google.com/store/books/details?id=fOnFvLIf8k0C&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=Working+with+Emotional+Intelligence+Daniel+Goleman&search_type=books&search%5Bfield%5D=on'},
  {'query': 'A SUITABLE BOY\nVIKRAM\nSETH\n20th ANNIVERSARY EDITION\nALEPH\n',
  'title': 'A Suitable Boy',
  'author': 'Vikram Seth',
  'google_link': 'http://books.google.co.in/books?id=F0kyMbpRLYwC&dq=A+SUITABLE+BOY+VIKRAM+SETH+20th+ANNIVERSARY+EDITION+ALEPH&hl=&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=A+Suitable+Boy+Vikram+Seth&search_type=books&search%5Bfield%5D=on'},
  {'query': "INDIA'S MOST FEARLESS\nSHIV AROOR\nRAHUL SINGH\n",
  'title': 'India's Most Fearless',
  'author': 'Shiv Aroor',
  'google_link': 'https://play.google.com/store/books/details?id=Sr42DwAAQBAJ&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=India%E2%80%99s+Most+Fearless+Shiv+Aroor&search_type=books&search%5Bfield%5D=on'},
  {'query': 'PENGUIN\nALLEN\nLANE\nDAVID & GOLIATH MALCOLM GLADWELL\n',
  'title': 'David and Goliath',
  'author': 'Malcolm Gladwell',
  'google_link': 'https://play.google.com/store/books/details?id=jmecJ7fbeagC&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=David+and+Goliath+Malcolm+Gladwell&search_type=books&search%5Bfield%5D=on'},
  {'query': 'ALLEN\nLANE\nTHE RISE\nand FALL of\nNATIONS\nRUCHIR\nSHARMA\n',
  'title': 'The Rise and Fall of Nations',
  'author': 'Ruchir Sharma',
  'google_link': 'http://books.google.co.in/books?id=PU51vgAACAAJ&dq=ALLEN+LANE+THE+RISE+and+FALL+of+NATIONS+RUCHIR+SHARMA&hl=&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=The+Rise+and+Fall+of+Nations+Ruchir+Sharma&search_type=books&search%5Bfield%5D=on'},
  {'query': 'Bentley\nProgramming Pearls\nPEARSON\nSecond Edition\n',
  'title': 'Programming Pearls',
  'author': 'Jon Bentley',
  'google_link': 'https://play.google.com/store/books/details?id=4gX0CwAAQBAJ&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=Programming+Pearls+Jon+Bentley&search_type=books&search%5Bfield%5D=on'},
  {'query': 'Vigence\nCover t Shter kcm\nRAHUL\nDRAVD\nDiSNEp\nESPICrificinfo\n',
  'title': '[Vigence Cover t Shter kcm RAHUL DRAVD DiSNEp ESPICrificinfo]',
  'author': '[unknown]',
  'google_link': 'https://www.google.com/search?q=Vigence+Cover+t+Shter+kcm+RAHUL+DRAVD+%C4%90iSNEp+ESPICrificinfo',
  'goodreads_link': 'https://www.goodreads.com/search?q=Vigence+Cover+t+Shter+kcm+RAHUL+DRAVD+%C4%90iSNEp+ESPICrificinfo&search_type=books&search%5Bfield%5D=on'},
  {'query': 'THIRD\nEDITION\nRussell\nNorvig\nArtificial Intelligence\nPearson\n',
  'title': 'Artificial Intelligence',
  'author': 'Stuart J. Russell',
  'google_link': 'http://books.google.co.in/books?id=8jZBksh-bUMC&dq=THIRD+EDITION+Russell+Norvig+Artificial+Intelligence+Pearson&hl=&source=gbs_api',
  'goodreads_link': 'https://www.goodreads.com/search?q=Artificial+Intelligence+Stuart+J.+Russell&search_type=books&search%5Bfield%5D=on'}]
```

```
In [ ]:
```