



Computer Vision: Intelligent Document Processing

Date: 05/07/2022



Outline

1) What has been done:

- 1) Running the API on all the subject datasets and Analysis. → Done on standard datasets. Basic Analysis on Tableau available without tesseract.
- 2) Blog → 70% done.

2) What is pending:

- 1) Running the APIs on the custom datasets.
- 2) Thorough analysis of all the results on Tableau.
- 2) Blog → 30% pending. (Results of all the dataset to be added, and observations to be added).

3) Observations

- 1) KPIs
- 2) Summary of the Preprocessing steps applied.

4) Next Steps

Data Sets

S. No.	Dataset Name	Size	Google	Amazon	Tesseract
1	Noisy Office 2007	144	✓	✓	✓
2	Smart Doc QA 2015	4260	✓	✓	✓
3	SROIE 2019	1000	✓	✓	✓
	Account Used:		Dhiraj's trial account	Sigmoid's trainee account + Abhjeet's personal account (760 rs bill approval?)	

Basic Results available on Tableau

KPIs

Category	KPI	Description	Observation
API's own score	Mean Confidence Score	API's own score	Both are similar
Dependent on the order of the text	WER	(No. of edits)/(total number of words in ground truth)	Amazon is better (~10% offset)
	CER	(No. of edits)/(total number of characters in ground truth)	
Not Dependent on the order of the text	Jaccard Index	$\text{len}(\text{intersection})/\text{len}(\text{union})$	Both are similar (Google is slightly better)
	Cosine Similarity	Convert the text to vector using countvectorizer.	

- 1) Google sorts the text from left to right. (Block wise)
- 2) Amazon sorts the text from top to bottom. (line wise)

Effect of word order on google and amazon

A03113

UNIHAKKA INTERNATIONAL SDN BHD
22 Mar 2018 18:24
(867388-U)
12, Jalan Tampoi 7/4, Kawasan Perindustrian
Tampoi, 81200 Johor Bahru, Johor
TAX INVOICE
Invoice #: OR18032202170428

Item	Qty	Total
SR 100100000035- 1 Meat + 3 Vege		
\$7.10	1	\$7.10
SR 100100000064-Add Vegetable		
\$0.50	1	\$0.50
Total Amount: \$7.60		
GST @6%: \$0.43		
Nett Total: \$7.60		
Payment Mode		
Amount		
CASH		\$7.60
Change		\$0.00
GST Summary		
Amount(\$)		
SR + GST @6%	7.17	0.43
GST REG #000856195584		
BAR WANG RICE@PERMAS JAYA		
(Price Inclusive Of GST)		
Thank You & Come Again!		
Like and Follow Us on Facebook!		
Facebook.com/BarWangRice		

Google Output

A03113

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Amazon Output

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Nett Total: \$7.60		
Payment Mode		Amount
CASH		\$7.60
Change		\$0.00
GST Summary		Amount (\$) Tax (%)
SR - GST @6%		7.17 0.43

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UNIHAKKA INTERNATIONAL SDN BHD 22 Mar 2018 18:24

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12, Jalan Tampoi 7/4, Kawasa
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Tampoi, 81200 Johor Bahru, J
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Invoice # : OR18032202170428

Qty

+Block 4

Item

SR 100100000035-1 Meat + 3 Ve
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\$ 7.10

+Block 5

SR 100100000064 - Add Vegeta
ble \$ 0.50

+Block 6

Payment Mode

CASH

Change

+Block 7

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+Block 8

GST Summary

SR - GST 6 %

+Block 9

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+Block 10

Amount (\$)

7.17

+Block 11

Total

+Block 12

\$ 0.50

Total Amount : \$ 7.60

GST @ 6 % : \$ 0.43

Nett Total : \$ 7.60

+Block 13

GST REG # 000656195584

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(Price Inclusive of GST) Thank
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Change	\$0.00

GST Summary	Amount(\$)	Tax(\$)
SR - GST @6%	7.17	0.43

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GST @6%: \$0.43

Nett Total: \$7.60

Payment Mode	Amount
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CASH

\$7.60

Change

\$0.00

GST Summary	Amount(\$)	Tax(\$)
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SR - GST @6%

7.17

0.43

GST REG #000656195584

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Effect of word order on google and amazon

Original Image

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Ground Truth

UNIHAHKA INTERNATIONAL SDN BHD
22 MAR 2018 18:24
(867388-U)
12, JALAN TAMPOI 7/4, KAWASAN
PERINDUSTRIAN
TAMPOI, 81200 JOHOR BAHRU, JOHOR
TAX INVOICE
INVOICE #: OR18032202170428

ITEM
QTY
TOTAL
SR 100100000035- 1 MEAT + 3 VEGE
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1
\$7.10
SR 100100000064-ADD VEGETABLE
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\$0.50
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NETT TOTAL: \$7.60
PAYMENT MODE
AMOUNT
CASH
\$7.60
CHANGE
\$0.00
GST SUMMARY
AMOUNT(\$)
TAX(\$)
SR - GST @6%
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0.43
GST REG #000656195584
BAR WANG RICE@PERMAS JAYA
(PRICE INCLUSIVE OF GST)
THANK YOU & COME AGAIN!
LIKE AND FOLLOW US ON FACEBOOK!
FACEBOOK.COM/BARWANGRICE

Google Output

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Item
SR 100100000035-1 Meat + 3 Vege
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SR 100100000064-Add Vegetable
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Payment Mode
CASH
Change
1
GST Summary
SR - GST 6%
1
Amount(\$)
7.17
Total
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Total Amount: \$7.60
GST @6%: \$0.43
Nett Total: \$7.60
GST REG #000656195584
BAR WANG RICE@PERMAS JAYA
(Price Inclusive of GST)
Thank You & Come Again!
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\$7.10
Amount
\$7.60
\$0.00
Tax(\$)
0.43
1

Amazon Output

AD3113
UNIHAHKA INTERNATIONAL SDN BHD
22 Mar 2018 18:24
(867388-U)
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Effect of word order on google and amazon

Ground Truth:

unihakka international sdn bhd 22 mar 2018 18 24 867388 u 12 jalan tampoi 7 4 kawasan perindustrian tampoi 81200 johor bahru johor tax invoice invoice # or18032202170428 item qty total sr i00100000035 1 meat + 3 vege 7 10 1 7 10 sr i00100000064 add vegetable 0 50 1 0 50 total amount 7 60 gst 6 0 43 nett total 7 60 payment mode amount cash 7 60 change 0 00 gst summary amount tax sr gst 6 7 17 0 43 gst reg #000656195584 bar wang rice permas jaya price inclusive of gst thank you & come again like and follow us on facebook facebook com barwangrice'

Google Output:

'a03113 unihakka international sdn bhd 22 mar 2018 18 24 867388 u 12 jalan tampoi 7 4 kawasan perindustrian tampoi 81200 johor bahru johor tax invoice invoice # or18032202170428 oty item sr 100100000035 1 meat + 3 vege 7 10 sr 100100000064 add vegetable 0 50 **payment mode cash change 1 gst summary sr gst 6 1 amount 7 17 total 0 50 total amount 7 60 gst 6 0 43 nett total 7 60 gst reg** #000656195584 bar wang rice permas jaya price inclusive of gst thank you & come again like and follow us on facebook facebook com barwangrice **7 10 amount 7 60 0 00 tax 0 43 1**

Amazon Output:

'ad3113 unihakka international sdn bhd 22 mar 2018 18 24 867388 u 12 jalan tampoi 7 4 kawasan perindustrian tampoi 81200 johor bahru johor tax invoice invoice # or18032202170428 item qty total sr 100100000035 1 meat + 3 vege 7 10 1 7 10 sr 100100000064 add vegetable 0 50 1 0 50 total amount 7 60 gst 6 0 43 nett total 7 60 payment mode amount cash 7 60 change 0 00 gst summary amount tax sr 7 17 0 43 gst reg #000656195584 bar wang rice permas jaya price inclusive oi gst thank you & come again like and follow us on facebook facebook com barwangrice'

API	CER	WER	Mean Confidence	Cosine Similarity	Jaccard
Google	28.4	44.5	92.2	0.97	0.5
Amazon	2.9	5.4	96.8	0.97	0.5

Preprocessing Steps Applied and Tried

S. No.	Noise Type	Treatment
1.	Motion Blurr / Out of Focus Blurr	Sharpening using 2D convolution
2.	Motion Blurr / Out of Focus Blurr	Convolution and Deconvolution
3.	Watermark	Contrast and brightness adjustment
4.	Watermark	Morphological Filtering (Shrinking and growing pixels)
5.	Any	Aligning and zooming the image using openCV

Next Steps

- 1) Reading research papers.
- 2) Watermark/stamp removing deep learning model
 - a) Creation of the dataset: using python code/ppt
 - b) Input: Image having, Output: Cleaned image
- 3) Blur removing Deep Learning Model.

Future Scope

While looking for how to deal with the deblurring the images, we came across some implementations that can be applied for treating the image to see more improvement in OCR APIs' performance.

- [DL Based Image deblurring survey paper](#)
- [Convolutional Neural Networks for Direct Text Deblurring](#)
- [Learning to Super-Resolve Blurry Face and Text Images](#)
- [L0-Regularized Intensity and Gradient Prior for Deblurring Text Images and Beyond](#)