

CHEQUE PROCESSING SYSTEM

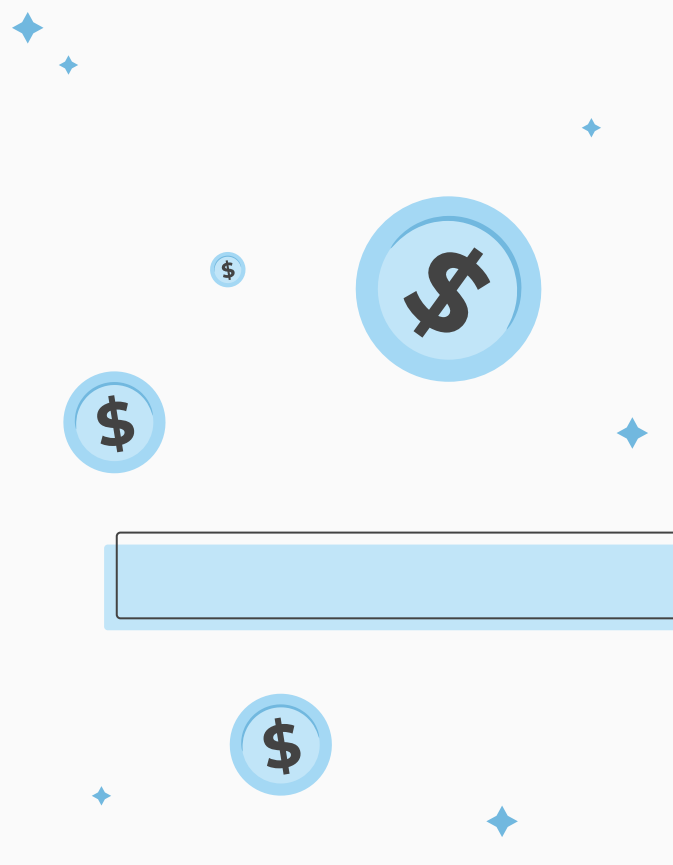
Smit Rana
Sharatkumar Patangi



OBJECTIVE

To create a system which extracts the Data from a Bank Cheque using MATLAB and Image Processing Techniques





"I don't think necessity is the mother of invention. Invention, in my opinion, arises directly from idleness, possibly laziness, to save myself trouble."

—AGATHA CHRISTIE

44,000

Number of Registered Banks in the World (2018 Survey)

5,153 MILLION

Cheques Deposited during 2017

8,438 \$ BILLION

Money Deposited via Cheques

- According to the data provided by the Federal Reserve System

STEPS TOWARDS THE SOLUTION



01 CLICK IMAGE

The basic and the manual step - Click the image of your Cheque

03 OCR

Pass the PreProcessed Cheques through **Optical Character Recognition**

02 PREPROCESS

First Step of our System
- Pass the cheque through various Image Processing Algorithms

04 DATABASE

Store the data and pass it for the final verification

PREPROCESSING

The Clicked Image is not ready for OCR, so it needs to be passed through various algorithms, selected after many experiments and trials and errors



THE 4 STEPS OF PREPROCESSING

01 NOISE REMOVAL

- `imgaussfilt`
- `bwareaopen`

03 REDUCE PROCESS POWER

- `Imresize`
- `regionprops`

02 DIMENSION REDUCTION

- `Rgb2gray`
- `im2bw`

04 CROPPING

- `cat & max`
- `imcrop`



01. NOISE REMOVAL

- No Image clicked by a camera can be without noise especially in the background which can interfere with our processing.
- So we pass our image through some noise removal techniques like
 1. Gaussian Filter
 2. BWAreaOpen

To remove the noisy pixels which are visible on right side of the image

VERIFY DOCUMENT AUTHENTICITY - COLORED AREA MUST CHANGE FROM GRADUALLY DARKER TO DARK AT TOP OF DOCUMENT AT BOTTOM

FORTY-NINER SHOPS INC
6049 E 7TH STREET
LONG BEACH, CA 90840

M7W
Payroll check number: 0015617576
Pay date: 02/10/2022

60-47711222

Pay to the order of: SMIT RANA

This amount: SEVEN AND 42/100 DOLLARS \$7.42

ASSISTANCE WITH VERIFICATION AVAILABLE AT 877-423-7243

VOID AFTER 180 DAYS

Wells Fargo Bank, N.A.
1401 California Ave
Bakersfield, CA 93309

ADP AUTHORIZED SIGNATURE

11561757611 1222047711 475903802911

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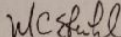
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02. DIMENSION REDUCTION

- There is no need for keeping the 3rd Dimension for an Image, It is just extra and unnecessary data which will be processed
 - So we pass our image through algorithms which will remove the unneeded dimension
1. `rgb2gray`
 2. `im2bw`

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FORTY-NINER SHOPS INC 6049 E 7TH STREET LONG BEACH, CA 90840	
MTW	CO-477/1222
Payroll check number:	0015617576
Pay date:	02/10/2022
Pay to the order of: SMIT RANA	
This amount:	SEVEN AND 42/100 DOLLARS
	\$7.42
ASSISTANCE WITH VERIFICATION AVAILABLE AT 877-423-7243	
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MTW
Payroll check number: 0015617576
Pay date: 02/10/2022

Forty-Niner Shops Inc
6049 E 7TH STREET
LONG BEACH, CA 90840

Pay to the order of: SMIT RANA
This amount: SEVEN AND 42/100 DOLLARS

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Wells Fargo Bank, N.A.
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APR 2022
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03. REDUCE PROCESS POWER & 04. CROPPING

- To further reduce processing power, We will reduce the size of the image which will make cropping the cheque as well as the sections consistent across more cheques
- We will use the following functions to achieve this
 1. `imresize`
 2. `regionProps`
 3. `cat & max`
 4. `imcrop`

VERIFY DOCUMENT AUTHENTICITY: COLORED AREA MUST CHANGE IN TONE GRADUALLY AND EVENLY FROM DARK AT TOP TO LIGHTER AT BOTTOM

FORTY-NINER SHOPS INC.
6049 E 7TH STREET
LONG BEACH, CA 90840

M7W

90-477/1222

Payroll check number: 0015617576

Pay date: 02/10/2022

Pay to the
order of:

SMIT RANA

This amount:

SEVEN AND 42/100 DOLLARS

\$7.42

ASSISTANCE WITH VERIFICATION AVAILABLE AT 877-423-7243

VOID AFTER 180 DAYS

Wells Fargo Bank, N.A.
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THE ORIGINAL DOCUMENT HAS AN ARTIFICIAL WATERMARK ON THE BACK. HOLD AT AN ANGLE TO VIEW THE LOGO ON THE FRONT OF THE

PS: This Cheque has 100% Accuracy of how much a computer engineer earns in 2022

OCR

Now that our cheque image is all suited up and ready for passing through Optical Character Recognition which is the **Heart of our Project**



- Widely used method in Computer Vision, Pattern recognition, and AI.
- Simple yet powerful method.
- Recognise and extract characters from a scanned document or an image.
- Converts written letters & symbols in a format that can be processed by computers.
- A newer version of OCR software uses a neural network that is capable of reading a whole sentence instead of a single character.

	1	2	3	4	5
34	3				
35	*				
36	/~il'»'IF.				
37	WU.9?9;é?!\$a.1li);2?li!533'f33J'?				
38					
39					
40	v 7w				
41	A				
42	»				
43	A				
44	90-477/1222				
45	FORTY-NINER				
46	SHOPS				
47	INC.				
48	Payroll				
49	check				
50	number:				
51	0015617576				
52	6049				
53	E				
54	7TH				
55	STREET				

Unnecessary
Data

Useful Data

**OCR
OUTPUT ON
THE WHOLE
CHEQUE**

detailsOfCheque	
1x1 ocrText	
Property ^	Value
Text	1x1175 char
CharacterB...	1175x4 double
CharacterC...	1175x1 single
Words	158x1 cell
WordBoun...	158x4 double
WordConf...	158x1 single

- PreProcessing not enough for the whole cheque
- SOLUTIONS
 1. Further cropping the image by roughly 5-10% from the edges
 2. MSER (maximally stable extremal regions)
 3. Extracting the Sections
- To Remove unnecessary data we need a database with sections of the cheques

OCR : EXTRACTING THE SECTIONS

- We have a limited amount of data fields that needed to be extracted
- Extracting the Sections also makes the OCR much faster
- We are using imCrop to extract the coordinates and fill our database with the required data
- For our experiment we are extracting 3 fields : *Name, Amount, Date*

chequeBounds ✕			
4x3 table			
	1 Fields	2 boundariesWF	3 boundariesUS
1	"Bank Name"	"Wells Fargo"	"NULL"
2	"Name"	"578.5100, 549.5100, 1.0769800000000000e+03, 77.980000"	"797.510000000000, 582.510000000000, 1118.980000000000, 122.980000000000"
3	"Amount"	"2948.510000000000, 660.510000000000, 446.980000000000, 86.980000000000"	"2759.510000000000, 618.510000000000, 461.980000000000, 101.980000000000"
4	"Date"	"2692.510000000000, 278.510000000000, 305.980000000000, 76.980000000000"	"2249.510000000000, 360.510000000000, 581.980000000000, 110.980000000000"

OCR : EXTRACTING FIRST SECTION

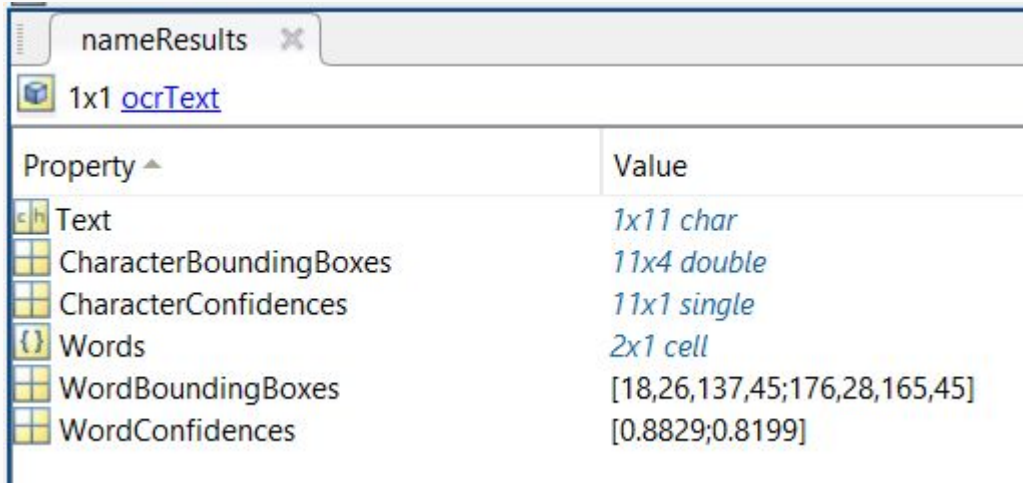
- Loading Bounding area for the Name field from the Database
- Running IMCROP on the cheque for the Bounding Area to get this result
- This cropped Image will be passed through OCR



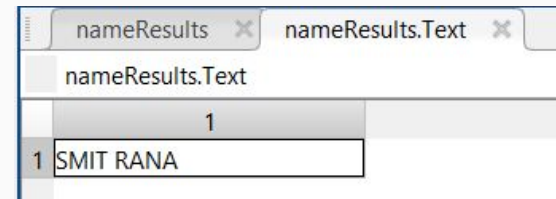
SMIT RANA

OCR : RESULTS

- Running the OCR Algorithm on the cropped Section, OCR contents recognizes the text, its Location, and the Accuracy of the Words as well as the Characters and Provides us with the ocrText type output



nameResults	
1x1 <u>ocrText</u>	
Property	Value
Text	1x11 char
CharacterBoundingBoxes	11x4 double
CharacterConfidences	11x1 single
Words	2x1 cell
WordBoundingBoxes	[18,26,137,45;176,28,165,45]
WordConfidences	[0.8829;0.8199]



nameResults		nameResults.Text	
nameResults.Text			
	1		
1	SMIT RANA		

OCR : RESULTS

nameResults.CharacterConfidences			
	1	2	3
1	0.9015		
2	0.9048		
3	0.9228		
4	0.9099		
5	NaN		
6	0.8276		
7	0.9014		
8	0.9114		
9	0.9115		
10	NaN		
11	NaN		
12			
13			

nameResults.CharacterBoundingBoxes						
	1	2	3	4	5	6
1	19	27	34	45		
2	57	28	43	45		
3	105	28	12	45		
4	120	29	37	44		
5	157	27	20	46		
6	177	28	36	45		
7	217	29	41	45		
8	261	30	37	44		
9	301	30	42	45		
10	343	27	0	0		
11	343	27	0	0		
12						
13						
14						

OCR : STORING IN DATABASE

- Output from the OCR is saved in the database
- This can be passed for final verification of the cheque (Once all field's data is extracted)

ExtractedData ✕				
4x2 table				
	1 Title	2 Data	3	4
1	"Bank Name"	"Wells Fargo"		
2	"Name on the Cheque"	"SMIT RANA"		
3	"Amount"	"\$7.42"		
4	"Date"	"02/1 0/2022"		

CHALLENGES

- Finding a Sweet Spot for the Preprocessing (Less time consuming and Efficient)
- Finding Database for Testing and Training
- Better Noise Removal Tools

TIME FOR A DEMO



FUTURE PROSPECTS

- Dynamically Finding the Sections
- Making a Standalone App or Module for an App
- Improving Preprocessing for any background
- Validation of Cheque and the Data (For which more and Proper Dataset Needed)
- Signature Verification : Requires many images of the same signature

THANKS

Does anyone have
any questions?

