OFFLINE SIGNATURE VERIFICATION USING CONVOLUTIONAL NEURAL NETWORKS

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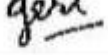
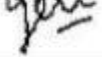
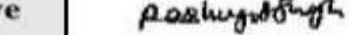
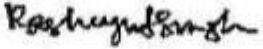
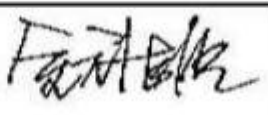
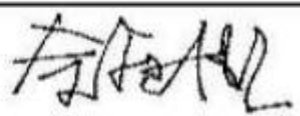
Contents

Introduction

- A signature is a person's name written in a distinctive way as a form of identification in authorizing a check or document or concluding a letter.
- Signature forgery refers to the act of falsely replicating the signature of another person.
- Why signature forgery is done?

Type	Genuine	Skilled forgery	Unskilled forgery
Simple			
Cursive			
Graphical			

Introduction...

- signature verification or forgery can be verified in two Methods :
- 1) Online Signature Verification
- 2) Offline Signature Verification

Challenges

- Differentiating different parts of signature that varies with each signing
- Isolating the sector of interest from the total input image.
- Signature orientation can be different.
- Input image may also contain noise.

Problem Definition

- Our main objective is to develop a method that will calculate features of a signature and verify it by using convolutional neural networks.
- We use deep neural networks

Related Work

- Research has been done using local features and global features like geometric features of the signature.
- GRID MODEL:
- 1)Image is partitioned into 8 horizontal parts
- 2)each part is partitioned into 12 boxes and calculate the summation of the angles of all points in each box taken with respect to the bottom left corner and normalize it for feature.
- The area of Handwritten signature verification has been broadly researched in the last decades, but remains an open research problem.

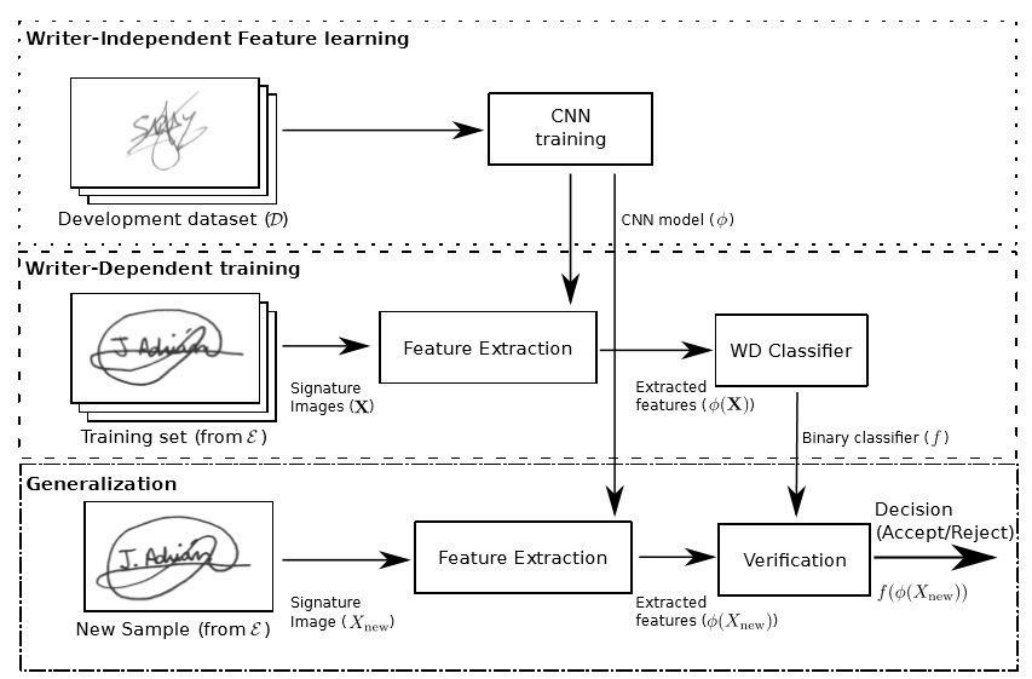
PROPOSED METHOD

- Two-stage approach
- 1)Writer-independent feature learning phase .
- 2)writer-dependent classification.

- Dataset is partitioned into two distinct sets:

- 1)Devolpment set(learning feature representation)
- 2)Exploitation set (Train the classifiers)

Proposed architecture



Pre-processing

- For all the signatures from both the datasets(D and E), we apply the same pre-processing strategy.
- 1)Size normalization and centering.
- 2)Removing the noise(using filters)
- 3)Removing the background(OTSU’s algorithm)
-

Writer-independent in feature learning

- In this process, we use a separate set of users(devolpment set D) to learn the features, Considering each user in D has a different class.

Table I
SUMMARY OF THE CNN LAYERS

Layer	Size	Other Parameters
Convolution	96x11x11	stride = 4, pad=0
Local Response Norm.	-	$\alpha = 10^{-4}$, $\beta = 0.75$, $k = 2$, $n = 5$
Pooling	96x3x3	stride = 2
Convolution	256x5x5	stride = 1, pad=2
Local Response Norm.	-	$\alpha = 10^{-4}$, $\beta = 0.75$, $k = 2$, $n = 5$
Pooling	256x3x3	stride = 2
Convolution	384x3x3	stride = 1, pad=1
Convolution	256x3x3	stride = 1, pad=1
Pooling	256x3x3	stride = 2
Fully Connected + Dropout	4096	$p = 0.5$
Fully Connected + Softmax	N	

Writer dependent classification

- After the CNN is trained in the set D, we use it to extract features for the writer-dependent training.
- For each user we build a writer-dependent training and testing set
- Training set:
  - Genuine signature for the user(positive examples) and genuine signature from other user(negative examples)
  - Testing set:
  - Genuine signature of the user and skilled forgeries made for the user.

Future work and conclusion

- Access to more resources would allow us to achieve better performance on our main task.
- Being able to train on a larger dataset with more signature examples per person could achieve higher accuracies.
- Convolutional neural networks does an excellent job of verifying signatures when allowed access during training to examples of genuine and forged signatures of the same people whose signatures are seen at test time.
- We present a good understanding on machine learning techniques for signature verification.

References

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