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Authenticating Handwritten Bengali Signatures with Deep Learning

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***Abstract*—In the field of information security, biometric systems play an important role. One area of study in biometrics is automatic signature identification and verification. This is important because people commonly use signatures to prove who they are, and some rules and laws accept signatures for this purpose. In this research, we look into how well a computer system can check if a Bengali signature is genuine, even when it's not done in real time (offline). Bengali signatures have a unique style that differs from signatures in Western languages. Although Bengali is the sixth most spoken language in the world, there have been very few attempts to authenticate Bengali signatures. Therefore, the issue of the Bengali signature verification needs to be addressed. This study uses several transfer learning techniques with Convolutional Neural Networks, for the sake of verifying Bengali signatures. To improve the accuracy and prediction of the models, the optimizers and hyper-parameters have been studied thoroughly to discover the ideal combination. A transfer learning approach, such as VGG-19, MobileNetV2, and Xception is used with customized CNN layers. A standard Bengali Dataset taken from Kaggle: BHSig60, is used to train our models which contain 5400 Bengali signatures of 100 people. Also we made a signature dataset of 10 people and added with the already available dataset. The MobileNetV2 model achieved the highest accuracy of 90.10%, conquering the rest of the models and promising an improvement in the authentication of Bengali Signature overall.**

I. Introduction

Signature verification is a vital step in ensuring the authenticity of documents and maintaining security. It plays a key role in confirming a person's identity. This process is essential for trustworthiness, ensuring that documents remain unchanged and reliable. In contemporary practices, manual visual verification of signatures is both tedious and prone to errors. The development of a robust signature verification system is a very crucial task to prevent document misrepresentation in high-profile industries such as business, finance, intelligence, and government. We aim to lead the way in creating a verification system that uses machine learning to verify Bengali signatures. This system not only ensures the accuracy of authentication but also makes sure that the process is faster.

The goal of this work is to make Bengali signatures more easily verified. We want to improve security and reduce the possibility of fraud in significant transactions where individuals are verified using their unique signatures. Nowadays, it's common practice to visually verify signatures, which can be tiring and error-prone. Our goal here is to develop a machine learning-based verification system that can prevent fraud and other criminal activities rapidly and precisely. Furthermore, it is not very popular to use this kind of work for Bengali signature verification these days; therefore, we aim to make it available to as many people as possible.

Bengali signature verification through machine learning is not yet widespread, and we aspire to democratize this technology, making it accessible to a broader audience. Our vision is to extend the benefits of advanced signature verification to as many people as possible, fostering a more secure environment for critical transactions.

We have witnessed the usefulness of using convolutional neural network architectures for signature verification. [1] Along with CNN architectures, studies have shown that using transfer learning can bring better results. [1] In this article, we are employing a step-by-step procedure to authenticate Bengali signatures. We are using an enriched dataset with 5400 signatures from a total of 100 people. We have also created a small dataset of our own, including 216 signatures from four people. We made sure the data was resized to a uniform size for better performance. We have employed a transfer learning method for our model. Then, we used customized convolutional neural network (CNN) architectures (VGG-19, MobileNet, and Xception) to decipher the unique patterns seen in Bengali signatures. To put it another way, we aim to build a method that can reliably and efficiently verify Bengali signatures to increase security, particularly in settings where signatures are crucial.