A Project Report

On

Fabric Authentication System Using Deep Learning

Centre for Development of Advanced Computing (C-DAC)

Diploma in Big Data Analytics

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Fabric Authentication System Using Deep Learning

Objective : The objective of this project is to distinguish between hand-made and machine-made clothing by classifying images based on various parameters. These parameters include texture and patterns, thread consistency, edges, seamlines, and the complexity of weave.

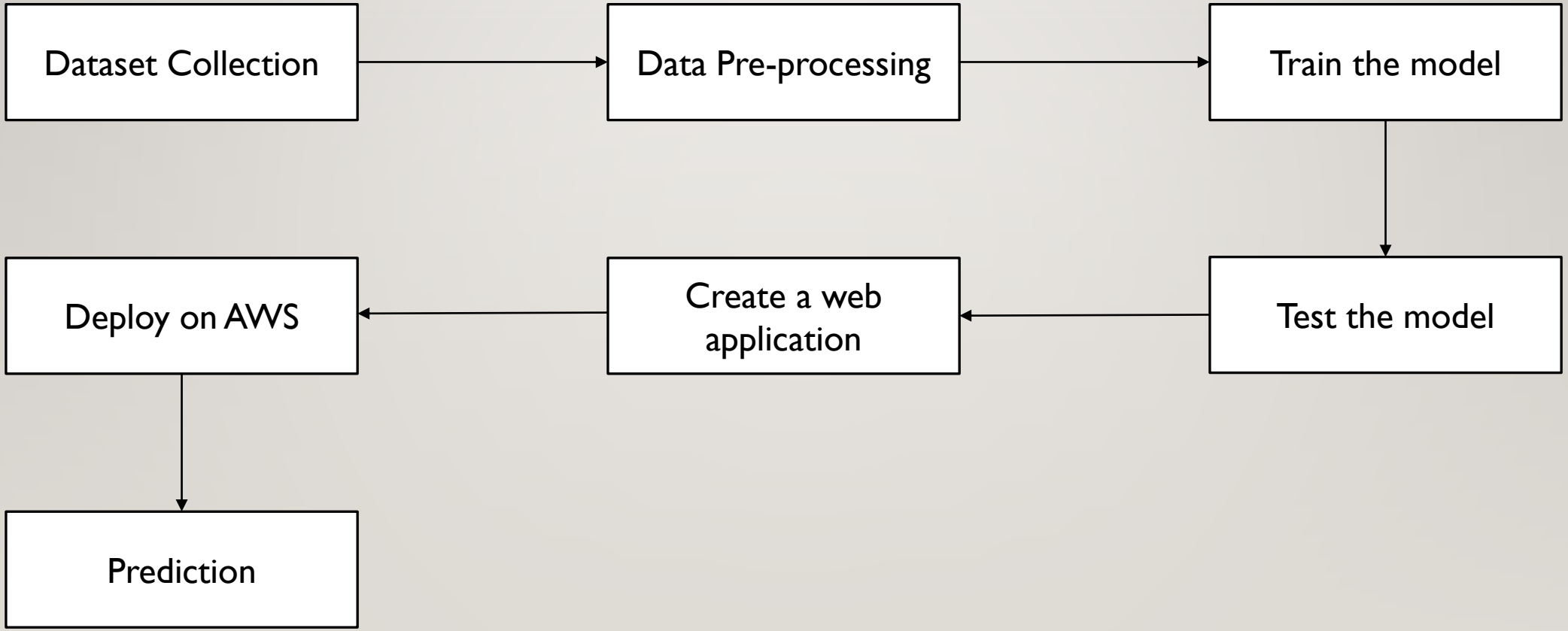
ABSTRACT

The texture of fabric is considered to be an important factor of the design and prediction of Machine-made fabric and handmade fabric. Traditionally, the recognition of fabric has a lot of challenges due to its manual visual inspection. Moreover, the approaches based on early machine learning algorithms directly depend on handcrafted features, which are time-consuming and error-prone processes. Hence, an AI system is needed for classification of fabric in Machine-made and Handmade.

In this Project Report, we propose a deep learning model based on data augmentation and learning approach for the classification and recognition of Difference between Machine-made and Handmade Fabric. The fabric images are enhanced by pre-processing at various levels using conventional image processing techniques and they are used to train the networks. The model uses the residual network **(VGG16).**We evaluated the results of our model using evaluation metrics such as accuracy, balanced accuracy, and F1-score. With the Fabric dataset, a maximum classification accuracy of **80%** is achieved in the conducted simulations. The experimental results show that the proposed model is robust and achieves state-of-the-art accuracy even when the physical properties of the fabric are changed. We compared our results with other baseline approaches and a pertained **Resnet50** deep learning model which showed that the proposed method achieved higher accuracy.

Also we create a Web Application of this model on Streamlit which is open-source framework to rapidly build web apps. It is a Python-based library specifically designed for machine learning engineers.

SYSTEM DESIGN



DATASET

Sample Data

Type of Fabric	No. of training samples	No. of Validation Samples	No. of testing samples
Machine-made	1560	195	195
Handmade	1560	195	195

Total No. of Samples=3900

Models Used In The Project

CNN

They require large amounts of training data and computational power to train and they are notoriously difficult to optimize.

ResNet50

The training process for ResNet-50 can be time-consuming and complex.

MobileNetV3

While MobileNetV3's design optimizes for efficiency, it may sacrifice some accuracy compared to larger and more complex architectures, especially on tasks where fine-grained details are crucial.

Inception-V3

It requires a large amount of computational resources and time for training due to its complex architecture.

VGG16

VGG16 is a pre-trained model with high accuracy in image classification.

VGG16 can extract rich features from images, leading to high accuracy in classification.

Deep Learning

Deep learning is a subset of machine learning that leverages multi-layered neural networks, known as deep neural networks.

These networks simulate the complex decision-making power of the human brain.

Unlike traditional programming, deep learning doesn’t require explicit rules; it learns from data.

Deep neural networks consist of interconnected layers that process and transform data.

Deep learning’s success lies in its ability to automatically learn and improve without manual feature engineering.

Convolutional Neural Network (CNN)

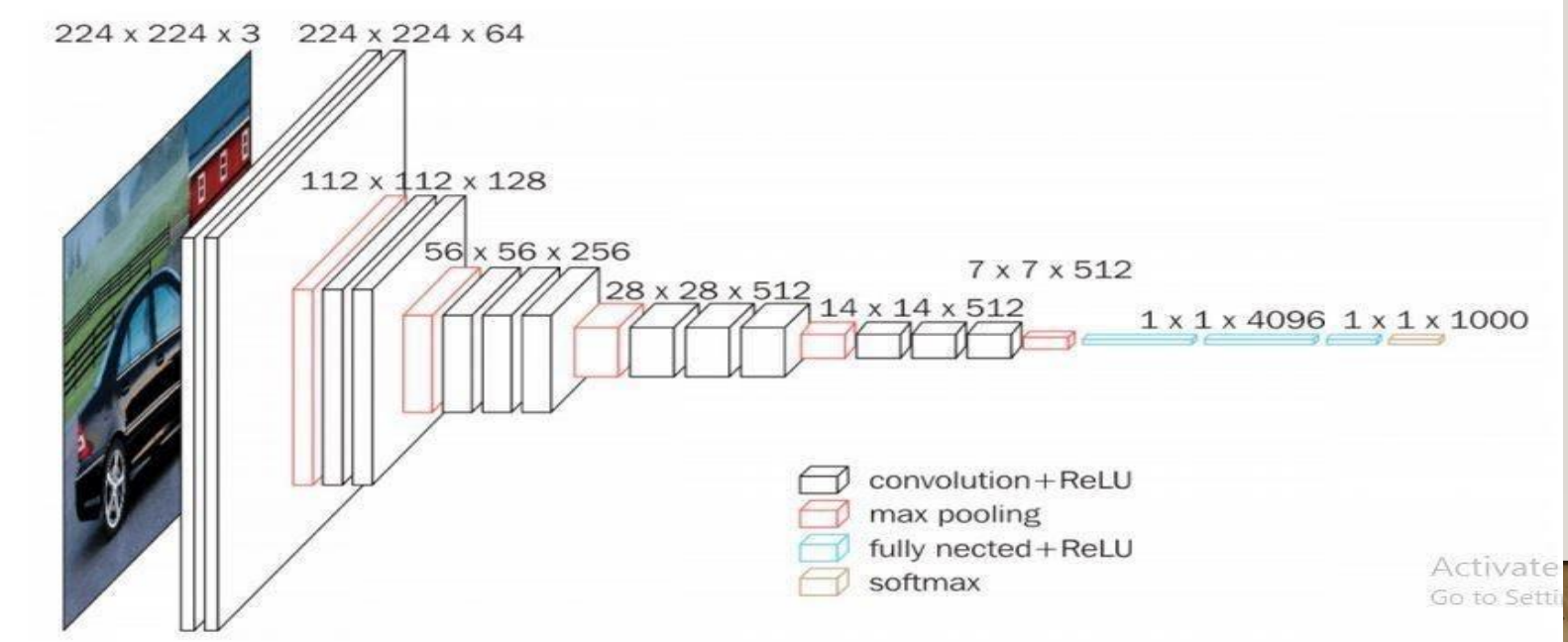
A CNN (also known as ConvNet) is a specialized type of deep learning algorithm primarily designed for tasks related to object recognition. These tasks include image classification, object detection, and segmentation.

Computer vision, a field of Artificial Intelligence, enables computers to understand and interpret visual data, such as images or videos.

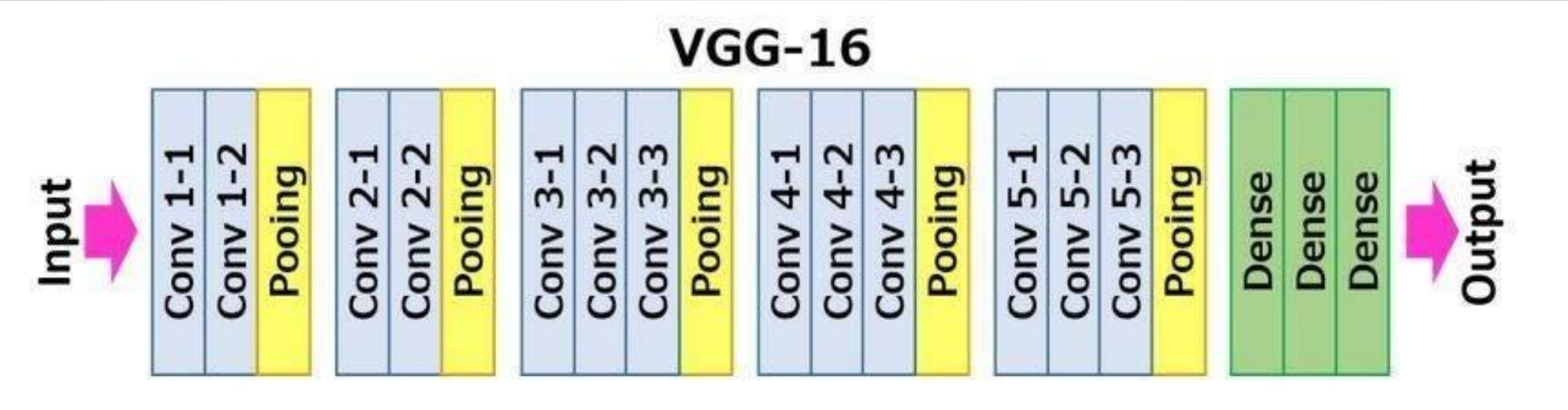
Proposed Method - VGG16

VGG16 is a type of CNN (Convolutional Neural Network) that is considered to be one of the best computer vision models to date. The creators of this model evaluated the networks and increased the depth using an architecture with very small (3 × 3) convolution filters, which showed a significant improvement on the prior-art configurations. They pushed the depth to 16–19 weight layers making it approx — 138 trainable parameters.

VGG16 is object detection and classification algorithm which is able to classify 1000 images of 1000 different categories with 92.7% accuracy. It is one of the popular algorithms for image classification and is easy to use with transfer learning.



Block Diagram of VGG16



Training data - 80%

Testing data - 10%

Validation data - 10%

Accuracy of VGG16

VGG-16 is an object detection and classification algorithm that has a 80% accuracy on Training Data .

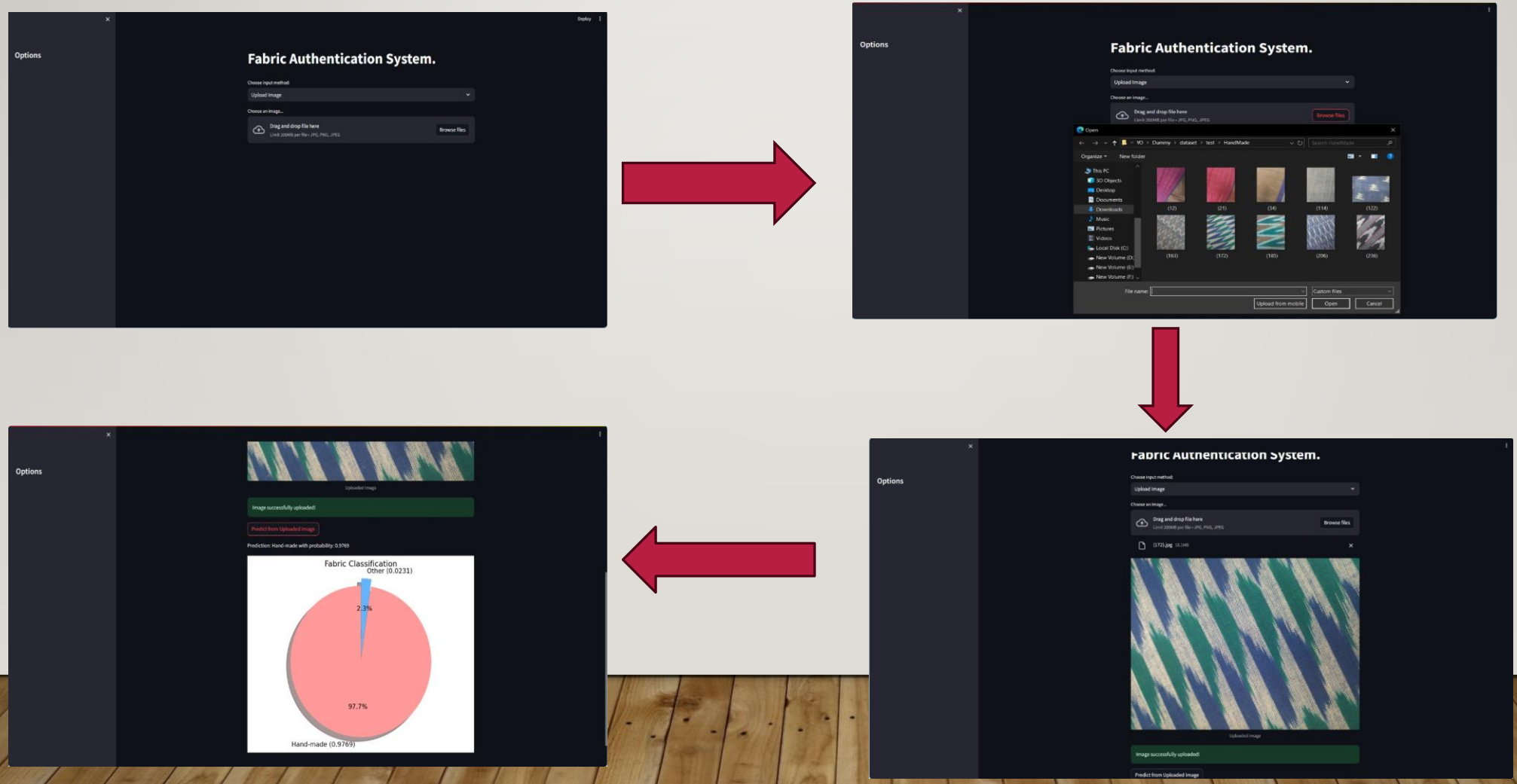
VGG-16 is an object detection and classification algorithm that has a 70% accuracy on Validation Data .

VGG-16 is an object detection and classification algorithm that has a 70% accuracy on Testing Data .

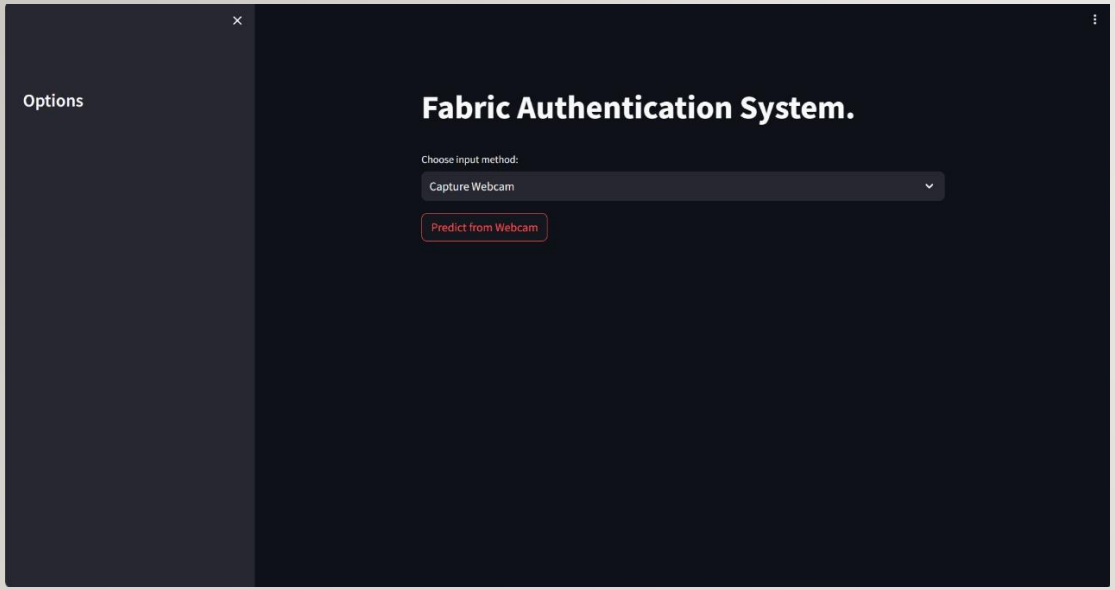
About Streamlit

Streamlit is a promising open-source Python library, which enables developers to build attractive user interfaces in no time.

For uploading the image:



For capturing the image:

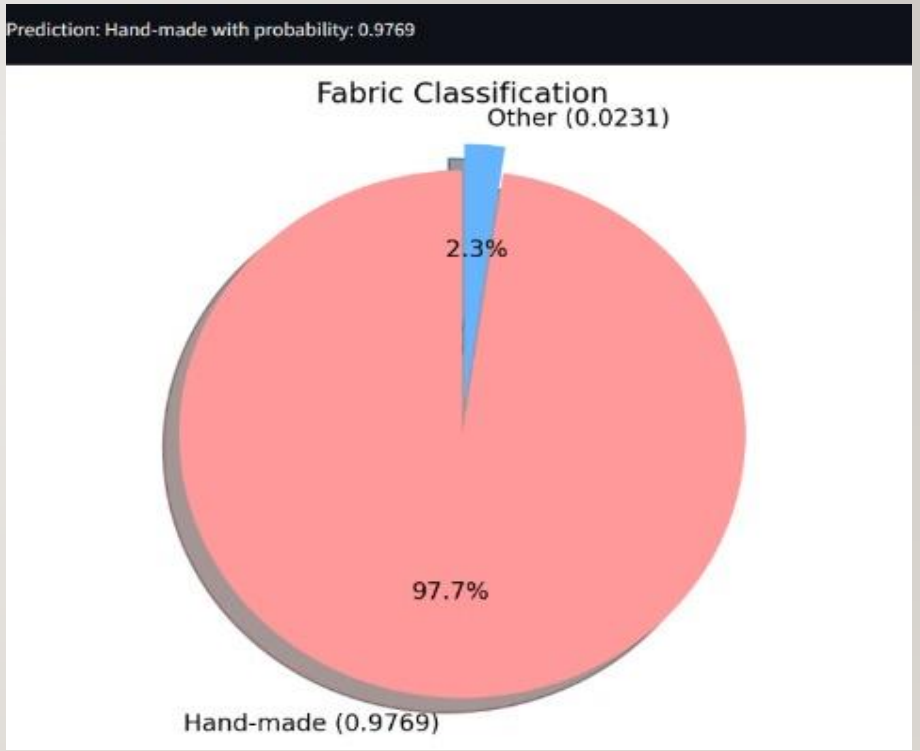


Result for Hand-Made

FINAL OUTPUT:

The following are the results

Input Fabric Image



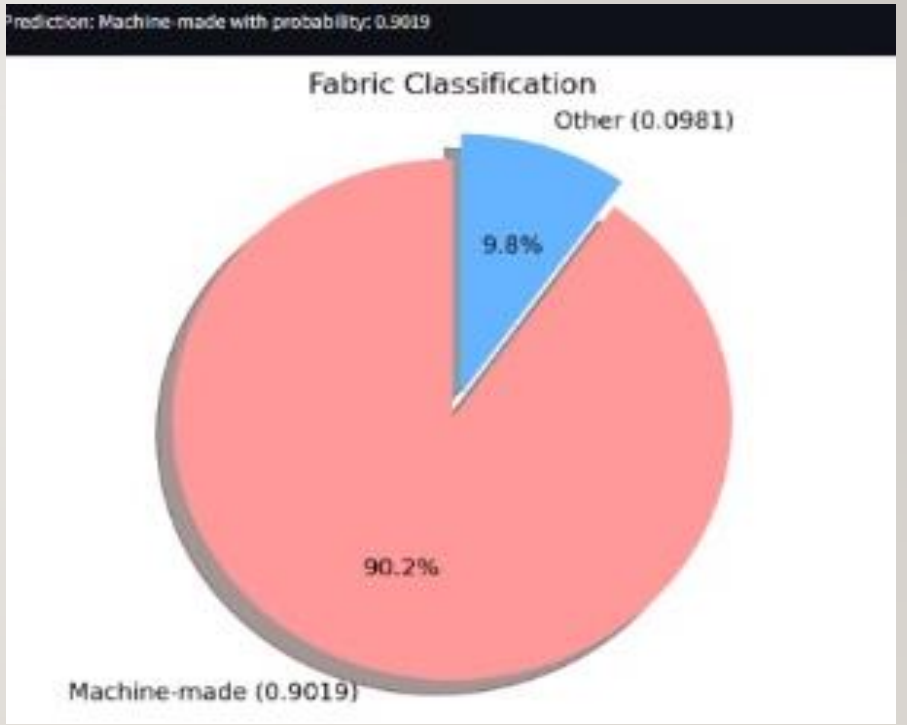
Result

Result for Machine-Made

FINAL OUTPUT:

The following are the results

Input Fabric Image



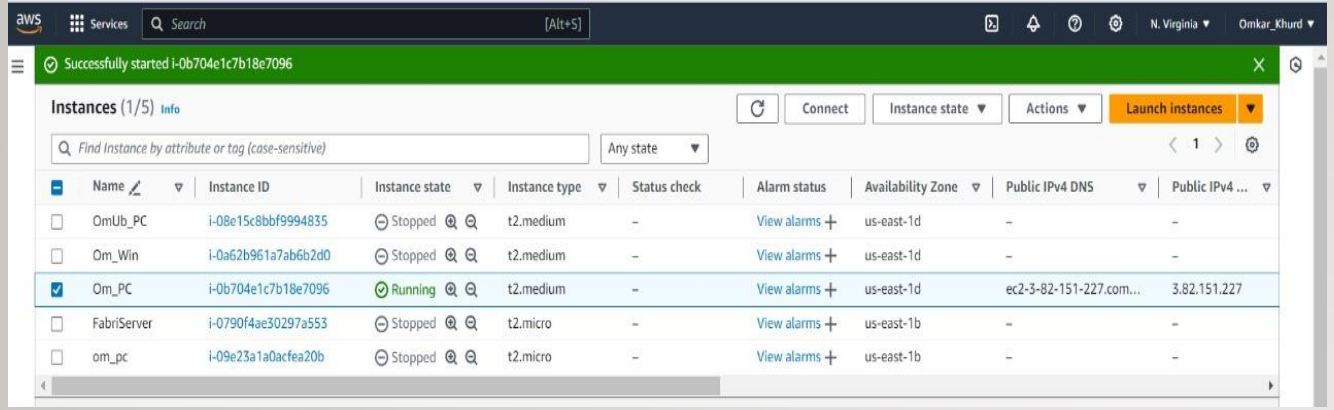
Result

Amazon Web Services

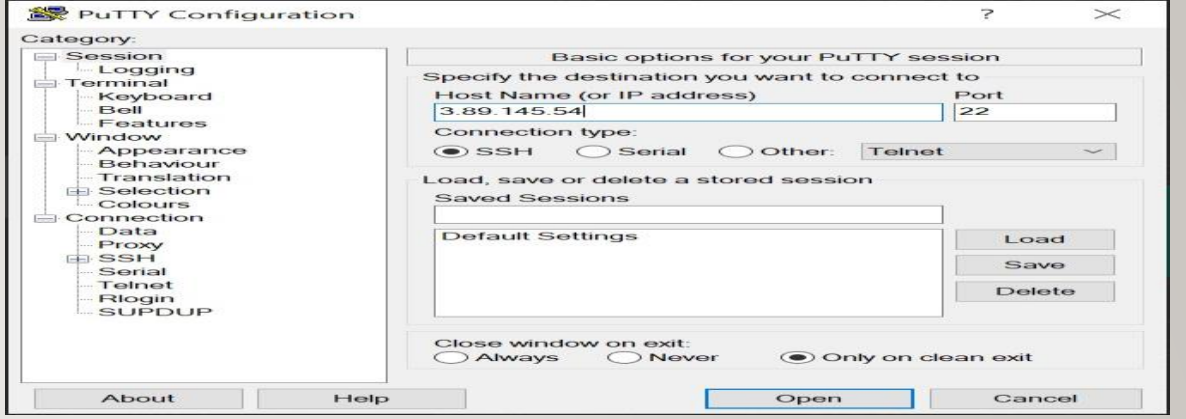
Amazon Web Services offers a broad set of global cloud-based products including compute, storage, databases, analytics, networking, mobile, developer tools, management tools, IoT, security, and enterprise applications: on-demand, available in seconds, with pay-as-you-go pricing. From data warehousing to deployment tools, directories to content delivery, over 200 AWS services are available.

Amazon Elastic Compute Cloud (EC2)

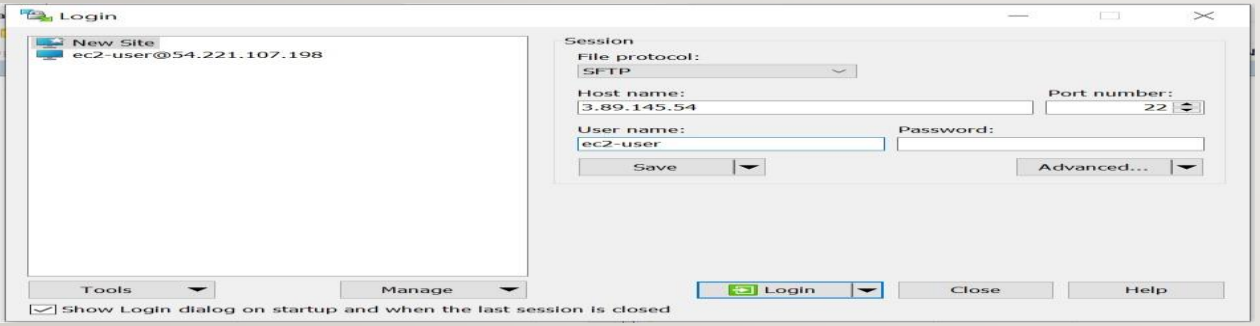
Amazon Elastic Compute Cloud (EC2) is a web service that offers on-demand computing capacity in the Amazon Web Services (AWS) cloud. It allows users to rent virtual computers to run their own applications.



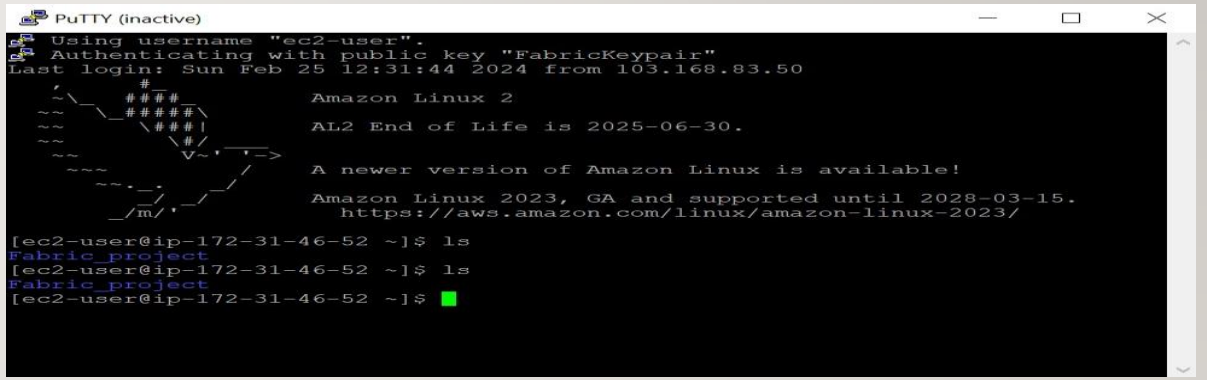
Step-1: we are create EC2 instance.we create costume machine on AWS.machine name is Amazon Linux machine.



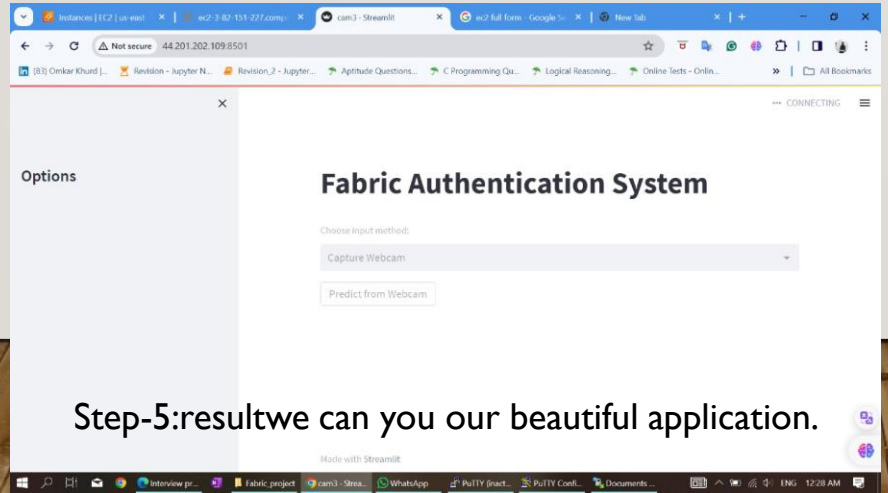
Step-2:for connecting server of ec2 instance, we need Putty application



Step-3:for sharing files to our ec2 instance directly, we need to use WinSCP application.



Step-4:CMD interface



Step-5:resultwe can you our beautiful application.

HARDWARE REQUIREMENTS

Processor	:	Intel i5 and above
Ram	:	8 GB and above
Hard Disk	:	1 TB and above

SOFTWARE REQUIREMENTS

Programming language	:	Python 3.7
IDE	:	Jupyter Notebook

Conclusion

The comparison between machine-made fabric and handmade fabric reveals a nuanced landscape shaped by factors such as technology, craftsmanship, sustainability, and consumer preferences. While machine-made fabrics offer scalability, consistency, and cost-effectiveness, handmade fabrics are valued for their uniqueness, cultural heritage, and artisanal craftsmanship.

Understanding market trends and consumer preferences, the fabric industry can adapt and thrive while preserving the artistry of handmade fabric and leveraging the efficiency of machine-made fabric

References

- https://en.wikipedia.org/wiki/Google_Scholar
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Thank you !