RAJIV GANDHI UNIVERSITY OF KNOWLEDGE AND TECHNOLOGIES
SRIKAKULAM,CAMPUS-3,ANDHRA PRADESH-521201
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SUBMITTED BY

T.Chaithra(s190689)
B.Keerrthana(s190698)
P.Madeenabe(s190862)
M.Chandana Sai Sri(s190200)

DEPARTMENT OF COMPUTER SCIENCE

GAN-BASED TELUGU CHARACTER GENERATION

ABSTRACT

It is hard to build effective machine learning models for Telugu language processing due to the lack of huge datasets including Telugu characters. We propose a method for creating huge datasets from pre-existing character datasets in order to address this problem. We employ sophisticated data augmentation methods on the original character images, like noise and scaling, to create new versions. Additionally, the dataset is expanded through the application of Generative Adversarial Networks (GANs) to produce realistic Telugu characters. Machine learning models perform better as a result of this method's increased volume and diversity of data. Assessments indicate that the accuracy and robustness of character recognition systems are enhanced by these enriched datasets. Additionally, by providing comprehensive data for training and testing, we support the advancement of Telugu language technology. Better Telugu character recognition abilities could be used for more than only machine learning applications; they could also be used to digitise and preserve historical documents, manuscripts, and other works of literature written in Telugu script. This improves access to Telugu heritage items and makes a significant contribution to cultural preservation projects.

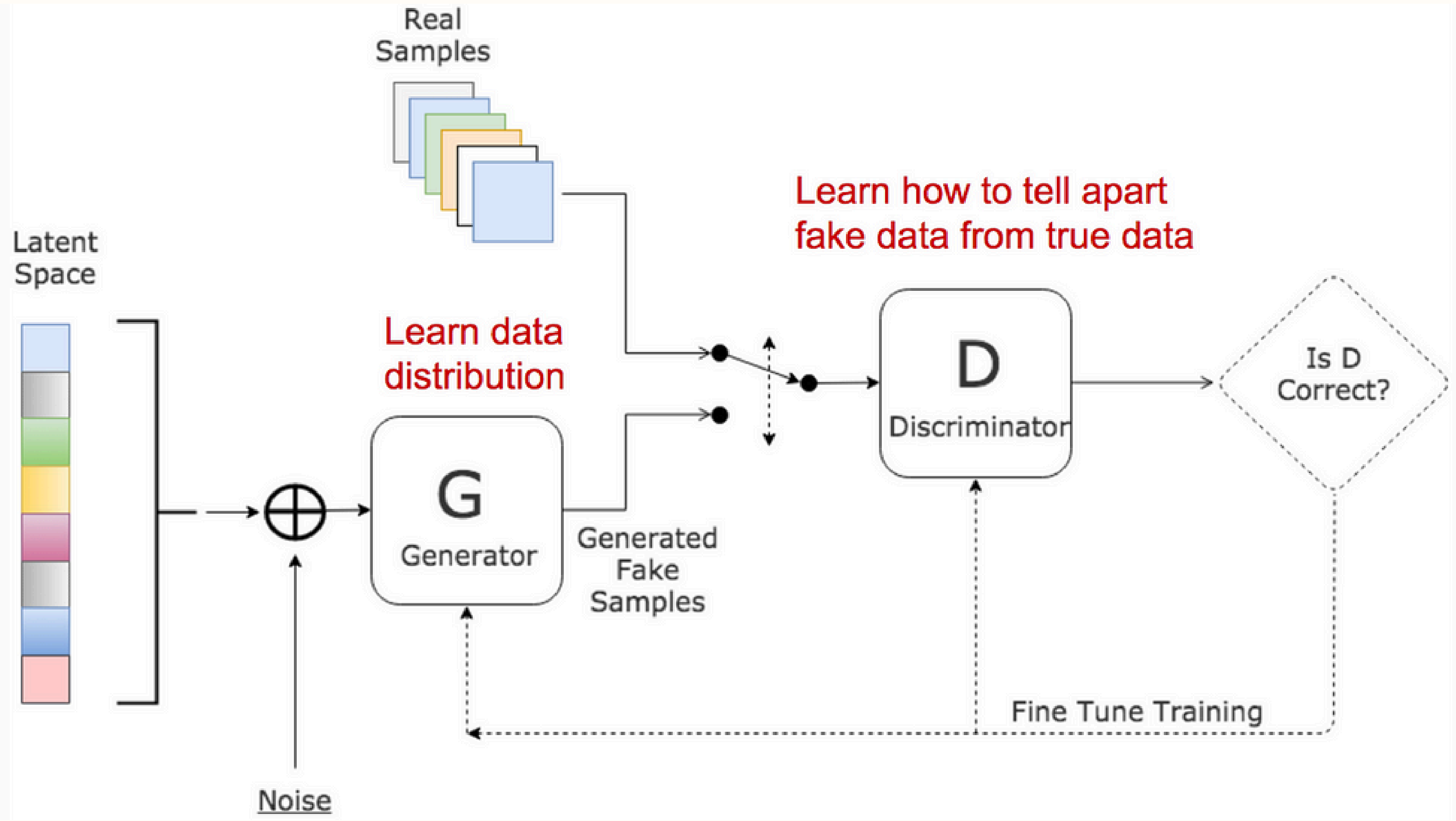
INTRODUCTION

OVERVIEW

This project leverages Generative Adversarial Networks (GANs) to generate high-quality synthetic Telugu characters, augmenting the dataset for training a robust generating model. By applying transfer learning and fine-tuning a pre-trained CNN with the enriched dataset, we significantly improve Telugu character recognition accuracy. This approach showcases the potential for enhancing generating systems in underrepresented languages.

BRIEF INTRODUCTION TO GANS

- **Generative Adversarial Networks (GANs)**
  - Introduced by Ian Goodfellow and his colleagues in 2014.
  - Consist of two neural networks: the Generator and the Discriminator.
  - **Generator:**
  - Creates synthetic data resembling real data.
  - Aims to fool the Discriminator by producing realistic samples.
  - **Discriminator:**
  - Evaluates whether data is real or generated.
  - Learns to distinguish between genuine and synthetic samples.



Existing System

- Description: An existing system for generating Telugu characters using machine learning algorithms trained on a limited dataset of Telugu characters.

Proposed System

- Utilize Generative Adversarial Networks (GANs) to create high-quality synthetic Telugu characters, augmenting the dataset.
- Implement transfer learning by fine-tuning a pre-trained convolutional neural network (CNN) with the enriched dataset.
- Enhance the model’s accuracy and robustness by leveraging diverse and comprehensive training data.
- Improve generalization to different handwriting styles and conditions.
- Demonstrate significant advancements over traditional methods in generating Telugu characters, showcasing potential for broader applications.

INTERNAL WORKING

Data Preprocessing and Loading:

Extracts character images as PNG files using computer vision techniques, then resizes, converts to grayscale, and normalizes them.

Splits the dataset into training and testing sets for model evaluation.

Generator Network:

Starts with a dense layer for a random noise vector, reshapes and upsamples it with transpose convolution layers to generate 28x28 grayscale images.

Utilizes batch normalization, Leaky ReLU activation, and a tanh activation in the final layer for output.

Discriminator Network:

Utilizes convolutional layers to downsample input images, outputs a single node with sigmoid activation to classify real or fake images.

Implements Leaky ReLU activation and dropout layers to enhance learning and prevent overfitting.

INTERNAL WORKING cont..

Training Loop:

Alternates between training the discriminator and generator networks, optimizing their performance iteratively.

Discriminator Training: Computes loss on real and fake images, updates weights with Adam optimizer. Generator Training: Generates fake images, computes loss based on discriminator feedback, updates weights to deceive the discriminator.

Loss Functions:

Employs binary cross-entropy to measure the divergence between predicted and actual labels (real or fake).

Optimizes discriminator and generator performance, enhancing overall model effectiveness through effective training guidance.

Visualization:

The code includes a function to visualize a subset of the generated images from the 'dataset' directory using matplotlib

APPLICATIONS

- **Dataset Augmentation:** GANs expand Telugu character datasets, crucial for training robust recognition models.
- **Font and Style Variation:** GANs enrich datasets with diverse Telugu typographical representations, enhancing model adaptability.
- **Handwriting Simulation**: GANs simulate natural Telugu handwriting styles, aiding in training handwriting recognition models.
- **Data Imputation:** GANs fill missing Telugu character data, ensuring comprehensive training datasets for models.
- **Interactive Design Tools**: GAN-generated Telugu characters enable custom font and graphic design creation.

CONCLUSION

In conclusion, our project successfully utilizes Generative Adversarial Networks (GANs) to create realistic and diverse Telugu characters. By harnessing pretrained models and synthetic data, we've achieved improved accuracy and efficiency in character generation. This approach has significant applications in OCR, language preservation, education, and automation, demonstrating its potential to enhance digital accessibility and cultural preservation of the Telugu language. Moving forward, further advancements in GAN techniques promise continued innovation in regional language processing and digital humanities.

Thank you!