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NeoLipi: A Multi-Script Ancient Inscription Recognition and Translation System Using Deep Learning

Ramya Vinayak Naik[1], Sahana R B[1], Sakshi Sanjay Hegde[1], Sathwika M D[1],

Prof. Shrinidhi A[2]

Students, Department of Computer Science and Engineering,

Vivekananda College of Engineering and Technology Puttur, Karnataka, India[1]

Assistant Professor, Department of Computer Science and Engineering,

Vivekananda College of Engineering and Technology Puttur, Karnataka, India[2]

Abstract: Ancient stone inscriptions contain valuable information about the history, culture, language, religion and ad-ministration of earlier periods. However, deciphering such inscriptions are difficult because the characters may be faint, broken, damaged or mixed with the texture of the stone. This paper presents NeoLipi, a multi-script ancient inscription recognition and Kannada translation system developed for Brahmi, Tamil(Vatteluttu) and Devanagari inscriptions. The system uses different recognition methods for the three script groups. The Brahmi pipeline performs image enhancement, binarization, line and character segmentation, stroke reconstruction and CNN-based character recognition. The Tamil pipeline performs binarization, stroke refinement, line seg-mentation, character extraction and CNN-based recognition. The Devanagari pipeline uses grayscale conversion, bilateral denoising, CLAHE, background normalization and an OCR-based recognition module. The recognized text is converted into digital text using Unicode mapping where required and is then translated into Kannada. The system is implemented using Python, OpenCV, NumPy, SciPy, TensorFlow/Keras and Streamlit. The proposed system provides a simple way to process historical inscription images and supports their digital preservation.

Keywords: Ancient inscriptions, Brahmi, Tamil, Devana-gari, CNN, OCR, image processing, Unicode, Kannada translation.

I. INTRODUCTION

Ancient inscriptions provide valuable information about the history, culture, language, and traditions of earlier civilizations. However, reading them manually is difficult because the characters may be faded, broken, or damaged by erosion and stone texture. Image processing and deep learning can help recognize these characters and preserve historical information.

NeoLipi is a multi-script ancient inscription recognition and Kannada translation system that supports Brahmi, Tamil, and Devanagari scripts. Due to the limited availability of labelled inscription datasets, the training dataset combines handwritten character samples with characters extracted from actual stone inscriptions.

For Brahmi inscriptions, the system performs image enhancement, segmentation, stroke reconstruction, and CNN-based character recognition. For Tamil, it uses binarization, line seg-mentation, character extraction, and CNN recognition. For Devanagari, the image is enhanced using denoising, CLAHE,and background normalization before OCR-based text extraction.

The recognized characters are converted into digital text using Unicode mapping where required and translated into Kannada. The system is developed using Python, OpenCV, NumPy, TensorFlow/Keras, SciPy, and Streamlit.

NeoLipi aims to simplify ancient inscription recognition, sup-port digital preservation, and make historical content more ac-cessible to Kannada-speaking students and researchers.

II. LITERATURE SURVEY

Dake et al. [1] proposed a method for restoring Brahmi stone inscriptions using an enhanced MobileNet approach. Their work shows that image restoration and deep learning can be useful for improving the readability of damaged Brahmi in-scriptions .

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Manivanan et al. [2] developed an automated Tamil inscription translator using deep learning for character recognition and epigraphic text formation. Their work shows the usefulness of deep learning for processing Tamil inscription characters .

Bhuvaneswari et al. [3] studied deep learning methods for recognising and analysing Tamil ancient inscriptions. Their work highlights the importance of image preprocessing and recognition methods when working with old inscription im-ages .

Narang et al. [4] proposed DeepNetDevanagari for recognition of ancient Devanagari characters. Their work shows that deep learning can be applied to the complex character structures of Devanagari.

Subramanyam et al. [5] proposed SIRS, a Stone Inscription Recognition System. The study demonstrates the usefulness of combining image processing and recognition stages for stone inscription analysis .

Uma Maheshwari et.al [6] compared different preprocessing methods for improving the legibility of ancient Indian script images captured from different stone backgrounds. The study indicates that preprocessing has a major effect on the quality of inscription images.

Kubatur et al. [7] presented a neural network approach for on-line Devanagari handwritten character recognition. The work demonstrates that neural networks can learn the visual patterns of Indic characters .

Manigandan et al. [8]created a way to read Tamil characters from stone marks using OCR and NLP. OCR. Separates the Tamil letters and NLP makes the read text easier to understand.

This research backs the idea of adding OCR and NLP parts to NeoLipi.
Pal et al. [9]Carried out a study on Devanagari handwritten character recognition. The study used a variety of features and classifiers. By comparing feature extraction techniques and classifiers Pal et al. Demonstrate how each choice can make a big difference in how accurately Devanagari handwritten char-acter recognition works. This study shows the im portance of picking the features and classifiers for Indian script recogni-tion.
From these studies, it can be observed that preprocessing, seg-mentation and deep learning are important for historical script recognition. The proposed system combines these techniques and uses different recognition methods according to the re-quirements of each supported script.

III. PROPOSED SYSTEM

The proposed system accepts an image of an ancient stone in-scription as input. The image is first processed to improve the visibility of the inscription. Based on the selected or identified script, the image is then passed to the corresponding recogni-tion pipeline.
The system mainly consists of the following stages:

- Image preprocessing and noise removal.
- Script selection or identification.
- Script-specific recognition.
- Digital text generation using recognition and Unicode map-ping.
- Kannada translation.
- Display of the final output through the Streamlit interface. The three recognition branches are described below.

Brahmi: Binarization, segmentation, character reconstruc-tion, CNN recognition and Brahmi Unicode mapping.
Tamil: Binarization, stroke refinement, line segmentation, character cropping, CNN recognition and Tamil Unicode map-ping.
Devanagari: Grayscale conversion, bilateral denoising, CLAHE enhancement, background normalization and OCR-based text recognition.
The use of separate pipelines makes the system more suitable for the different shapes and processing requirements of the three scripts.

IV. METHODOLOGY

Brahmi Recognition: The Brahmi image is enhanced us-ing grayscale conversion, CLAHE, thresholding, and noise re-moval. Lines and characters are segmented using projection profiles and connected components. Broken strokes

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are im-proved using thinning and reconstruction. A CNN model rec-ognizes the characters, which are mapped to Brahmi Unicode.

A. Tamil Recognition

The Tamil image undergoes binarization, border removal, and stroke refinement. HPP and VPP are used to segment lines and characters. The extracted characters are resized to 128 × 128 pixels and recognized using a CNN model. The output is converted into Tamil Unicode and translated into Kannada.

B. Devanagari Recognition

The image is processed using grayscale conversion, bilateral filtering, CLAHE, and background normalization. The en-hanced image is passed to an OCR module to extract Devana-gari text, which is then translated into Kannada.

V. SYSTEM ARCHITECTURE

The overall workflow of the proposed system is shown in Fig-ure 1. The process begins with an ancient stone inscription image. After preprocessing, the image is sent to the selected or identified script branch.

The Brahmi branch has 254 classes. The stone inscription im-age undergoes image binarization, segmentation, stroke recon-struction and character CNN recognition. The predicted class is then converted to Brahmi Unicode and used for Kannada translation.

In the Tamil branch, binarization and stroke refinement are followed by line segmentation and character cropping. Each standardized character is recognized by the CNN model and converted into Tamil Unicode using the 247-class mapping. The recognized text is then translated into Kannada.

In the Devanagari branch, grayscale conversion, bilateral de-noising, CLAHE and background normalization are followed by OCR-based text recognition. The recognized Sanskrit text is then translated into Kannada.

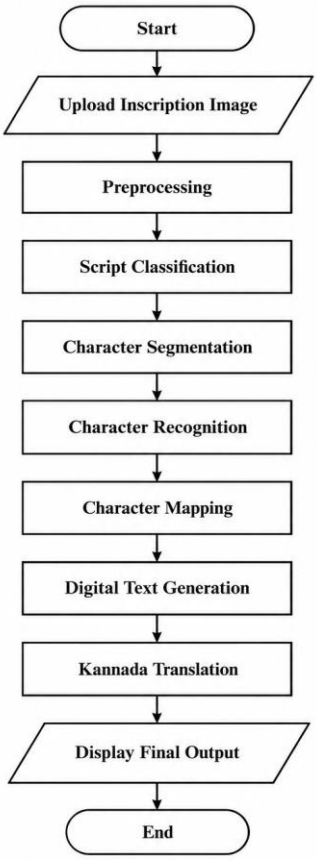


Figure 3.4: Workflow Diagram

Figure 1: Flowchart Diagram of NeoLipi

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VI. IMPLEMENTATION AND RESULTS

A. Recognition and Translation Output

The developed NeoLipi system provides recognition and Kan-nada translation for three script groups: Brahmi, Tamil, and Devanagari. The output depends on the script selected for the uploaded inscription image. Each script follows a different processing approach based on its recognition requirements.

For Brahmi inscriptions, the system preprocesses the image, converts it into a binary representation, and segments it into in-dividual character regions. Broken character components are reconstructed wherever required. A CNN-based model recognizes the segmented characters, which are mapped to Brahmi Unicode to generate digital text and its Kannada translation.

For Tamil inscriptions, the system performs image preprocessing, stroke refinement, and line segmentation. Individual char-acters are extracted, resized, and passed to the trained CNN model. The predicted classes are mapped to Tamil Unicode characters, and the recognized Tamil text is translated into Kannada.

For Devanagari inscriptions, the system enhances the complete image using grayscale conversion, denoising, contrast enhancement, and background normalization. The enhanced image is processed using an OCR-based recognition module without explicit character-level segmentation. The extracted text is then translated into Kannada.
Overall, NeoLipi combines image processing, CNN-based recognition, Unicode mapping, and OCR-based text extraction to digitize inscriptions and make their content more accessible to Kannada users.

B. System Interface and Sample Outputs

The NeoLipi system interface is shown in 2. The Brahmi char-acter extraction and recognition results are illustrated in Fig-ures 3 and 4, respectively. The Tamil (Vatteluttu) recognition output is shown in Figure 5, while the Devanagari recognition and Kannada translation output is presented in Figure 6.

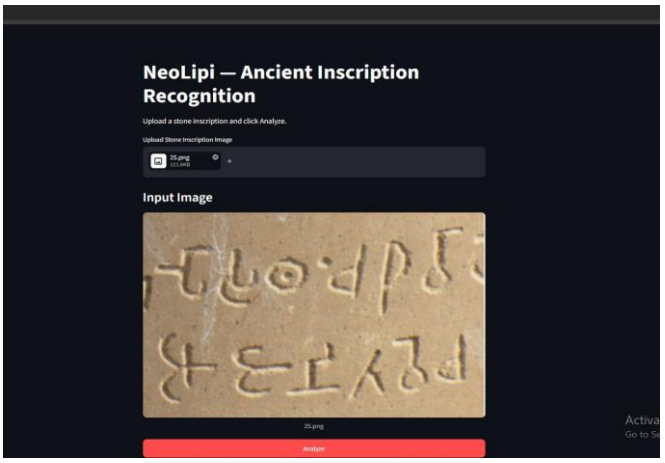


Figure 2: NeoLipi system interface



Figure 3: Brahmi character Extraction

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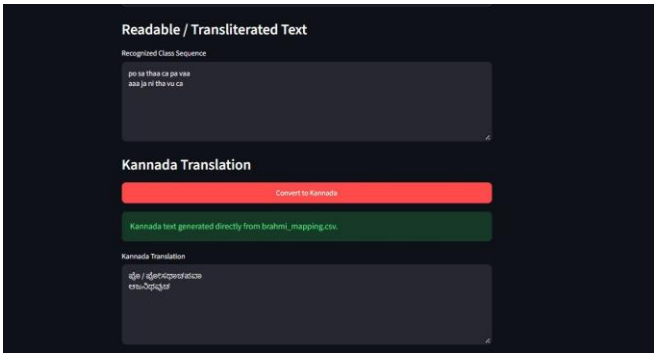


Figure 4: Brahmi recognition output

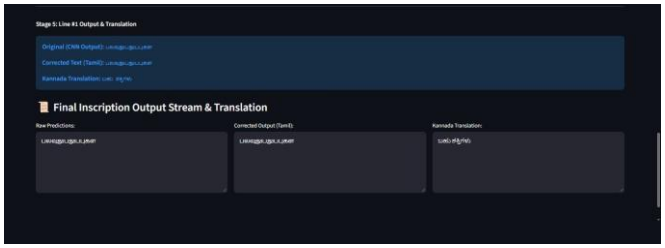


Figure 5: Tamil (Vatteluttu) recognition output

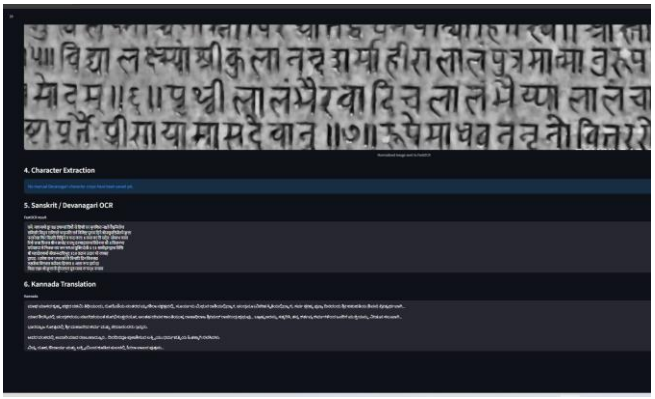


Figure 6: Devanagari recognition and Kannada translation

VII. CONCLUSION

This paper presented NeoLipi, a multi-script ancient inscription recognition and Kannada translation system for Brahmi, Tamil and Devanagari inscriptions. The system uses different recognition pipelines because the three scripts have different character structures and processing requirements.

The Brahmi branch performs image enhancement, binarization, segmentation, stroke reconstruction and CNN-based character recognition. The Tamil branch performs binarization, stroke refinement, line segmentation, character extraction and CNN-based recognition. The Devanagari branch per-forms grayscale conversion, bilateral denoising, CLAHE enhancement and background normalization before OCR-based recognition.

The recognized text is converted into digital text and translated into Kannada. The Streamlit interface provides a simple way for users to upload an inscription image and view the processed output. The system can support the digital docu-mentation and preservation of historical inscriptions and can be useful for students and researchers working with ancient scripts.

A. Scope for Future Work

Future work can focus on expanding the labelled stone-inscription dataset, improving recognition of damaged and connected characters, and evaluating the system on a wider range of inscription images. The translation stage can also be improved through specialist validation to better preserve historical meaning and context.

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REFERENCES

[1] A. Dake, P. Chavan, H. Pawar, Y. Dharme, and P. Borude, "Restoration of Brahmi stone inscriptions us-ing enhanced MobileNet approach," International Jour-nal of Engineering Research & Technology (IJERT), vol. 15, no. 6, Jun. 2026.

[2] P. Manivanan, R. Premrajesh, P. Senthamil Selvi, and K. Murugananthi, "An automated Tamil inscription translator using deep learning for robust character recogni-tion and epigraphic text formation," International Jour-nal of Emerging Trends in Engineering and Development (IJETED), vol. 16, no. 2, 2026, pp. 32/1–32/10, doi: 10.5281/zenodo.19634765.

[3] S. Bhuvaneswari and K. Kathiravan, "Enhancing epig-raphy: A deep learning approach to recognize and analyze Tamil ancient inscriptions," Neural Computing and Applications, vol. 36, pp. 19839–19861, 2024, doi: 10.1007/s00521-024-10137-x.

[4] S. R. Narang, M. Kumar, and M. K. Jindal, "Deep-NetDevanagari: A deep learning model for Devana-gari ancient character recognition," Multimedia Tools and Applications, vol. 80, pp. 20671–20686, 2021, doi: 10.1007/s11042-021-10775-6.

[5] A. T. Subramanyam, H. S. Parveen, C. Sindhu, K. S. Sai, S. Cibisundar, A. Venkadeshwar, and R. Vinoth Kumar, "SIRS: Stone Inscription Recognition System," in International Conference on ICT for Sustainable Development. Springer, 2024, pp. 123–134.

[6] P. Uma Maheshwari, "Comparative study: Enhancing legibility of ancient Indian script images from diverse stone background structures using 34 different prepro-cessing methods," 2023.

[7] S. Kubatur, M. Sid-Ahmed, and M. Ahmadi, "A neu-ral network approach to online Devanagari handwritten character recognition," in 2012 International Conference on High Performance Computing & Simulation (HPCS), 2012, pp. 209–214.

[8] [11] T. V. V. D. V. N.B.Manigandan, V. Vidhya, V. Dhanalakshmi, and B. Nirmala, "Tamil character recognition from ancient epigraphical inscription using OCR and NLP," in 2017 International Conference on Energy, Communication, Data Analytics and Soft Computing (ICECDS), pp. 1008–1011, IEEE, 2017.

[9] U. Pal, T. Wakabayashi, and F. Kimura, "Comparative study of Devanagari handwrit ten character recognition using different feature and classifiers," in 2009 10th Inter national Conference on Document Analysis and Recog-nition, pp. 1111–1115, IEEE, 2009.

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