BHASHA-2025

S.No. (Paper Code): 25

IJCNLP-AACL 2025

Multi-Feature Graph Convolution Network for Hindi OCR Verification

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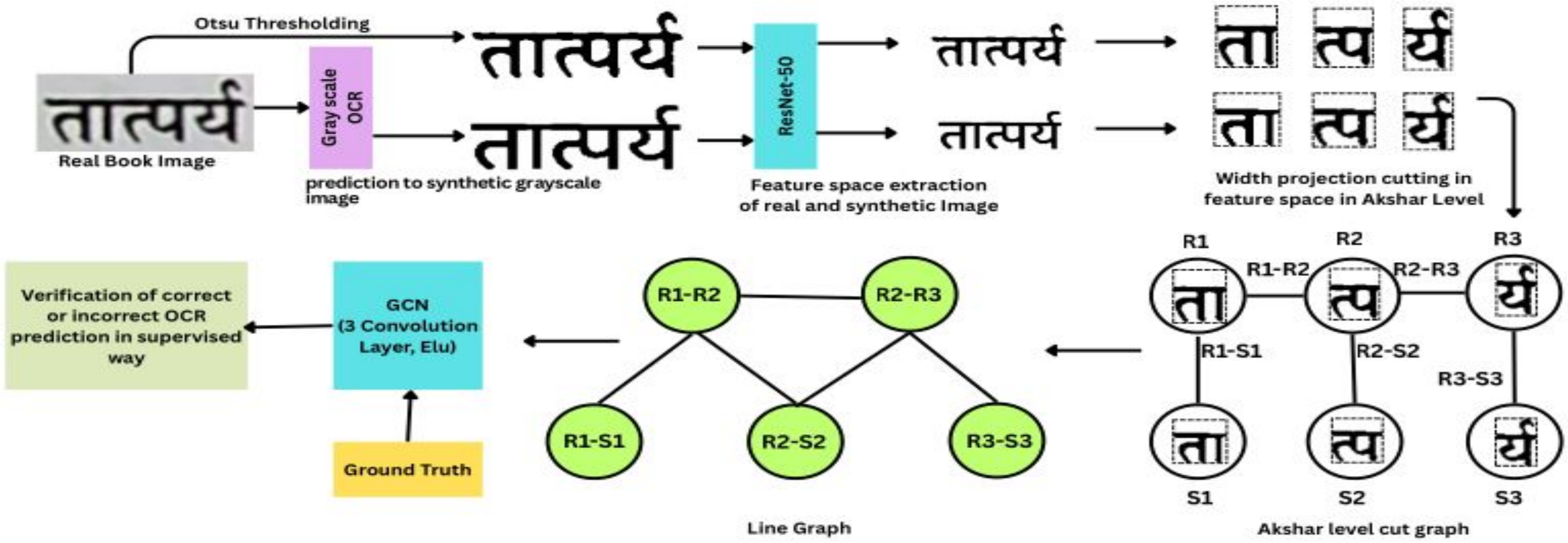


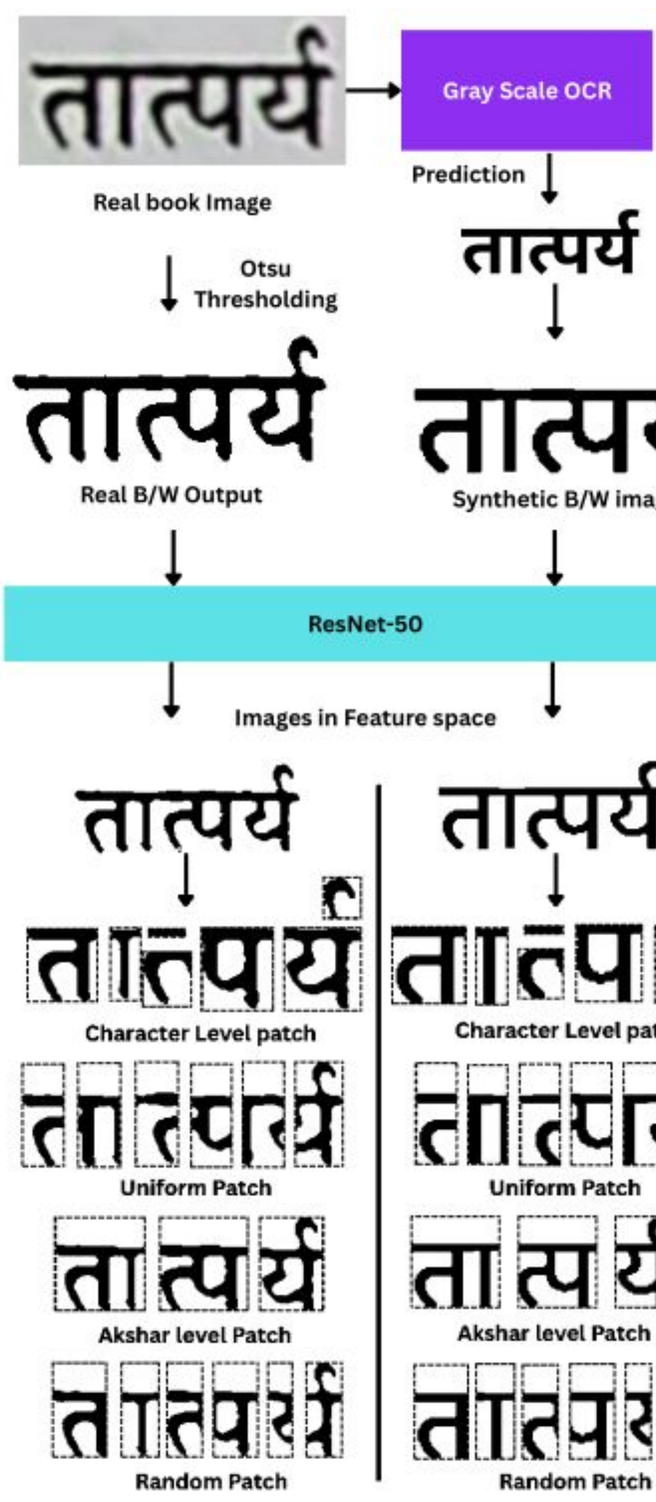
Abstract

Problem: Traditional OCR struggles with complex Hindi script features like conjuncts and matras, especially in historical or degraded documents.

Solution: We propose a novel **Graph Convolutional Network (GCN)** framework to verify OCR predictions by comparing real book images against synthetic images generated from OCR output.

Method: The model extracts features using **ResNet-50** and constructs a line graph where nodes represent character pairs.

Features: Verification uses semantic (Cross-Entropy) and geometric features (Hu moments, Pixel count) to detect errors.



Comparison of GNN Architectures

Model Architecture	Precision	Recall	F1-Score
Our Model (3-Layer GCN)	**0.7357**	0.4285	0.5413
APPNPNet	0.6727	0.6826	0.6825
TAGNet	0.6726	0.6603	0.6485
GATConv	0.6571	0.6309	0.6067

Our 3-Layer GCN achieves the highest precision, minimizing false alarms.

Performance of Patching Strategies

Patching Strategy	Precision	Recall	F1-Score
Akshar-level	**0.6727**	0.6926	**0.6825**
Character-level	0.5363	**0.726**	0.6169
Random Patch	0.624	0.6602	0.6416
Uniform Patch	0.5327	0.7051	0.6069

Linguistically informed "Akshar-level" patching performs best.

Conclusion

Effectiveness: The framework effectively verifies OCR in diverse Hindi documents, specifically targeting challenging conjunct characters.

Linguistic Alignment: Aligning feature segmentation with Hindi linguistic structure (**Akshara-level**) significantly outperforms random or uniform segmentation.

Future Scope: We plan to extend this approach to other Indic scripts and integrate attention mechanisms to capture broader contextual dependencies.

Acknowledgement

We thank **BharatGen, DST, and TiH-IITB** for their funding support. Special gratitude to **Shayan Mohanty** and **Thoughtworks AI Research** for enabling this collaboration. We also appreciate the **reviewers** for their constructive feedback.