

Overview & Executive Summary

Paper: DocEng Short Paper - Cost-Aware Human-LLM Collaboration for Post-OCR Corrections

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GitHub: <https://github.com/Stergios-Konstantinidis/Cost-Aware-Human-LLM-Collaboration-for-post-OCR-Corrections>

Overleaf: <https://git.overleaf.com/6a2cb93de1bec86186ee8613>

1. Research Motivation & Core Problem

Historical document archives, such as digitized centuries-old Swiss newspapers, suffer from substantial OCR degradation caused by aged paper, bleed-through, complex multi-column typography, and antique fonts.

While modern Large Language Models (LLMs) excel at OCR correction, naive **all-to-LLM pipelines** suffer from three severe pitfalls:

1. **Financial Cost:** Processing millions of archive pages with commercial LLM APIs is economically non-viable.
2. **Degradation of Clean Text:** LLMs frequently "hallucinate" or modernize archaic French spellings on segments that were already correctly transcribed by the OCR engine.
3. **Severe OCR Failures:** On heavily damaged regions, LLMs fabricate plausible-sounding text instead of preserving historical fidelity.

This paper formulates OCR post-correction as an **optimal budget allocation and routing problem** uniting human domain experts and LLMs.

2. Key Contributions

- **Three-Tier Human-LLM Collaboration:** Explicit routing of each segment to either *(1) No Correction*, *(2) Automated LLM Correction*, or *(3) Human Review*.
 - **Regression-Guided Prioritization:** Learned Lasso/Ridge router predicting expected Character Error Rate (CER) reduction $\hat{\Delta}_i$ before sending tokens to an LLM.
 - **Post-LLM Safeguard Layer:** Classification mechanism detecting when LLM correction introduced regression or hallucination, diverting compromised outputs to human reviewers.
 - **Superior Budget Efficiency:** Achieves **14% relative CER reduction** over the All-LLM baseline with **<5% human review budget**.
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