Detecting Manual Alterations in Biological Image Data Using Contrastive Learning and Pairwise Image Comparison

Daniil Dorin
MIPT
Moscow, Russia
dorin.dd.contact@gmail.com

Georgii Nekhoroshkov
MIPT
Moscow, Russia
nekhoroshkov.gs@phystech.edu

Andrii Hraboviy
MIPT
Moscow, Russia
grabovoy.av@phystech.edu

Abstract

In this paper, we address the problem of detecting manipulations in biological images. Ensuring the integrity of biological image data is essential for reliable scientific research. The study focuses on developing a model for pairwise image comparison using contrastive learning, demonstrating high pairwise comparison metrics to detect manual modifications or more subtle alterations. The proposed method outperforms state-of-the-art models, including CLIP and Barlow Twins, in the task of biological image comparison on fMRI scans and cell datasets. This work contributes to automated fraud detection and data validation in biological research.

Keywords: Machine Learning, Pairwise Image Comparison, Fine-Tuning, Automated Fraud Detection, Detecting Data Alterations

1 Introduction

TODO

Contributions. Our contributions can be summarized as follows:

- We present...
- We demonstrate the validity of our theoretical results through empirical studies...
- We highlight the implications of our findings for...

Outline. The rest of the paper is organized as follows...

2 Related Work

Topic #1. TODO

Topic #2. TODO

Preprint. Under review.

3 Preliminaries

3.1 General notation

In this section, we introduce the general notation used in the rest of the paper and the basic assumptions.

3.2 Assumptions

TODO

4 Experiments

To verify the theoretical estimates obtained, we conducted a detailed empirical study...

5 Discussion

TODO

6 Conclusion

TODO

References

A Appendix / supplemental material

A.1 Additional experiments

TODO