

Evaluating Deep Learning Methods for Detection of AI Generated Images: A Study on CIFAKE

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Abstract. In a world full of images and data, where artificial intelligence is now more powerful than ever and can generate complex and lifelike digital media, it is essential to maintain a well-defined line between real content and AI-generated creations. Therefore, these authors propose a comparison between two machine learning techniques aimed at classifying images: a custom Convolutional Neural Network (CNN) and a Residual Neural Network (ResNet).

The custom CNN architecture relies on multiple convolutional layers to extract hierarchical features from the images, pooling layers for dimensionality reduction, and fully connected layers for final classification. On the other hand, the ResNet introduces residual connections, or skip connections, allowing the network to mitigate the vanishing gradient problem and train deeper architectures effectively. ResNet is particularly well-suited for capturing complex patterns in image data by preserving information across layers.

Our attention will be focused on the CIFAKE dataset, a large dataset containing both AI-generated images and real photographs, labeled as 'Fake' and 'Real.' We will present the final results of both architectures alongside the methodology and experiments conducted. Relevant metrics such as accuracy, precision, and F1-score will be used to compare the two approaches.

These experiments are crucial in an era dominated by artificial intelligence to maintain ethical and secure use of media across the internet and to address potential future legal implications.

Keywords: First keyword · Second keyword · Another keyword.

1 Introduction

In the recent years, the field of synthetic image generation through the use of artificial intelligence (AI) has evolved quickly, and as such there's a critical need to detect these images to guarantee authenticity.

Our research tries to make the following contributions:

- Applying and optimizing deep learning established architectures in order to detect AI generated images
- Employing adversarial attacks on the aforementioned architectures in order to test their robustness.

The paper is constructed as follows. Section 2 mentions the related work regarding the detection of AI synthetic images. Section 3 describes the dataset used in the research, while section 4 delineates the methodology followed and the description of the experiments. Finally, section 5 presents and discusses the results obtained and section 6 concludes the paper.

2 Related work

The rapid advancements in image generation techniques, such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs) and diffusion models have shifted the attention to the detection of these AI generated images.

3 Data

4 Methodology

Hardware and software resources The library employed for the detection of AI synthetic generated images was Keras (maybe link??). For reproductability purposes, we set the seed to 42. All algorithms in this study were run on Google Colab resources.

5 Results and discussion

6 Conclusion

6.1 A Subsection Sample

Please note that the first paragraph of a section or subsection is not indented. The first paragraph that follows a table, figure, equation etc. does not need an indent, either.

Subsequent paragraphs, however, are indented.

Sample Heading (Third Level) Only two levels of headings should be numbered. Lower level headings remain unnumbered; they are formatted as run-in headings.

Sample Heading (Fourth Level) The contribution should contain no more than four levels of headings. Table 1 gives a summary of all heading levels. Displayed equations are centered and set on a separate line.

$$x + y = z \tag{1}$$

Please try to avoid rasterized images for line-art diagrams and schemas. Whenever possible, use vector graphics instead (see Fig. 1).

Table 1. Table captions should be placed above the tables.

Heading level	Example	Font size and style
Title (centered)	Lecture Notes	14 point, bold
1st-level heading	1 Introduction	12 point, bold
2nd-level heading	2.1 Printing Area	10 point, bold
3rd-level heading	Run-in Heading in Bold. Text follows	10 point, bold
4th-level heading	<i>Lowest Level Heading.</i> Text follows	10 point, italic

Fig. 1. A figure caption is always placed below the illustration. Please note that short captions are centered, while long ones are justified by the macro package automatically.

Theorem 1. *This is a sample theorem. The run-in heading is set in bold, while the following text appears in italics. Definitions, lemmas, propositions, and corollaries are styled the same way.*

Proof. Proofs, examples, and remarks have the initial word in italics, while the following text appears in normal font.

For citations of references, we prefer the use of square brackets and consecutive numbers. Citations using labels or the author/year convention are also acceptable. The following bibliography provides a sample reference list with entries for journal articles [1], an LNCS chapter [2], a book [3], proceedings without editors [4], and a homepage [5]. Multiple citations are grouped [1–3], [1, 3–5].

Acknowledgments. A bold run-in heading in small font size at the end of the paper is used for general acknowledgments, for example: This study was funded by X (grant number Y).

Disclosure of Interests. It is now necessary to declare any competing interests or to specifically state that the authors have no competing interests. Please place the statement with a bold run-in heading in small font size beneath the (optional) acknowledgments¹, for example: The authors have no competing interests to declare that are relevant to the content of this article. Or: Author A has received research grants from Company W. Author B has received a speaker honorarium from Company X and owns stock in Company Y. Author C is a member of committee Z.

References

1. Author, F.: Article title. Journal **2**(5), 99–110 (2016)
2. Author, F., Author, S.: Title of a proceedings paper. In: Editor, F., Editor, S. (eds.) CONFERENCE 2016, LNCS, vol. 9999, pp. 1–13. Springer, Heidelberg (2016). <https://doi.org/10.1007/1234567890>

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3. Author, F., Author, S., Author, T.: Book title. 2nd edn. Publisher, Location (1999)
4. Author, A.-B.: Contribution title. In: 9th International Proceedings on Proceedings, pp. 1–2. Publisher, Location (2010)
5. LNCS Homepage, <http://www.springer.com/lncs>, last accessed 2023/10/25