Entropy and complexity analysis of AI-generated and human-made paintings

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Creativity is the ultimate characteristic of human intellect and expression, and it is inextricably linked to art. Previous research works attempted to analyze and parameterize the manifestations of art, but they had not escaped the human factor. However, the advent of Artificial Intelligence (AI) models has shaken up the research world, raising questions about the nature of creativity and whether in its artistic form it is a uniquely human quality. In this work [1], we aim to examine the relationship between creativity and the nature of the creator by using paintings created by both AI and humans in various artistic genres. By analysing the paintings through a mathematical lens, utilizing an entropy analysis formulated by the classic Shannon entropy (E) and a complexity (C) measure based on multi-scale entropy, we hope to gain a deeper understanding of the prowess of AI models and possible new insights into the ability to distinguish between a human-created work (H) and an AI-generated one (AI).

We present findings on the general comparison between AI-generated and human-made art, as well as on the more specific analysis of 8 different genres within these two categories. Based on the results, we observe that differences between AI and human art can be found not only in the schematic representation, but also in the colour changes, with the AI finding it more complicated to represent painting styles without well-shaped objects, as well as colour changes regarding pixels of similar intensity values. AI generated paintings seem to encapsulate a general definition for the structural elements of an artistic genre, but may not fully capture the diversity of artist styles within that genre. Additionally, the AI and H differences depend on the genre of the works, thus, grouping based on art styles is possible. As for the ability of prediction with good accuracy whether an artwork is AI or H made based on the metrics of complexity and entropy, the dispersion of the C, E values exceeds the difference of the averages, offering indication that although the difference found is statistically reliable, it has little predictive power.

References

[1] E.-M. Papia, A. Kondi, V. Constantoudis, Entropy and complexity analysis of AI-generated and human-made paintings, Chaos Solit. Fractals, 170, 113385 (2023).