

Quantifying Copyright in Generative AI

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PROBLEM

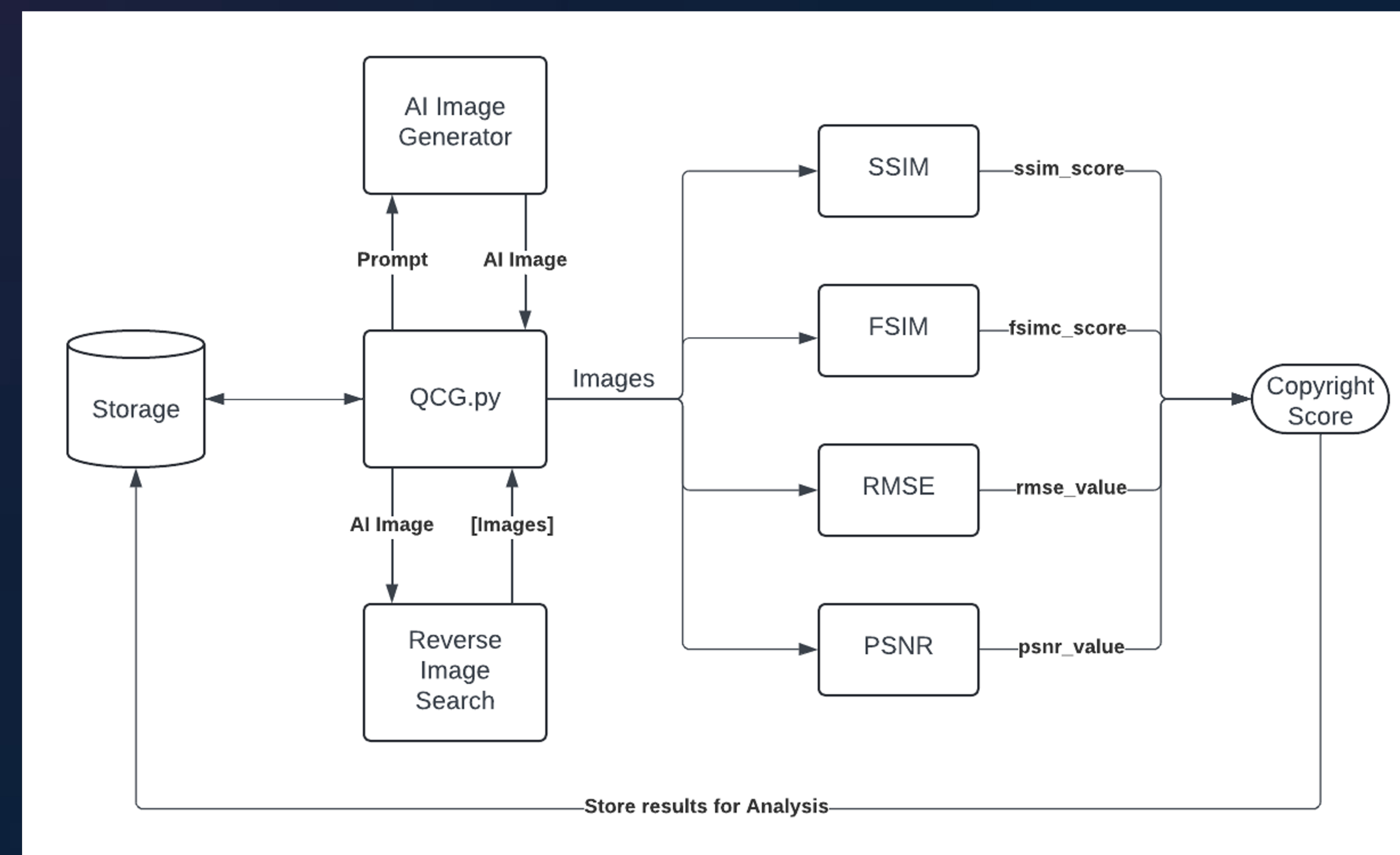
The capacity to produce and create inventive results, generative artificial intelligence (AI) has revolutionized a wide range of industries, including music, writing, design, and the arts. However, the increasing popularity and use of generative AI presents a significant difficulty in regulating and evaluating copyright ownership of the results produced by AI. The complexity of AI-generated works is beyond the scope of traditional copyright rules and frameworks, creating uncertainty and legal problems around ownership, usage rights, and attribution.

Our work focuses on measuring copyright infringement with particular reference to artificial intelligence-generated images. Four basic metrics—substantial resemblance, derivative work analysis, originality threshold evaluation, and study of transformative use—are what we argue can be used to determine copyright infringement.

QUANTIFIERS

Structural Similarity Index Measure (SSIM)	Assesses visual impact based on luminance, contrast, and structure between two images, thus a higher SSIM value mean greater similarity
Feature Similarity Index Measure (FSIM)	Result calculated based on two main features: phase congruency (PC) and gradient magnitude (GM). These features are considered because they significantly contribute to human visual perception
Root Mean Square Error (RMSE)	In image processing, RMSE is used to quantify the difference between two images. A lower value indicates a higher similarity.
Peak Signal-To-Noise Ratio (PSNR)	Used to measure the quality of reconstruction of lossy compression codecs, with higher values indicating better quality. While a higher PSNR suggests that the image is closer to the original.

IMPLEMENTATION



THRESHOLDS

Based on the insights from a key studies mentioned in the references, and from what we analyzed our dataset of similar AI-generated and copyrighted images. We established clear thresholds for our comparison metrics: SSIM is set at 50%, indicating visual similarity; FSIM at 30%, focusing on feature similarity; RMSE is below 0.04, showing minimal differences; and PSNR is above 30 dB, indicating high similarity. These thresholds are crucial for identifying potential copyright infringements.

SUMMARY

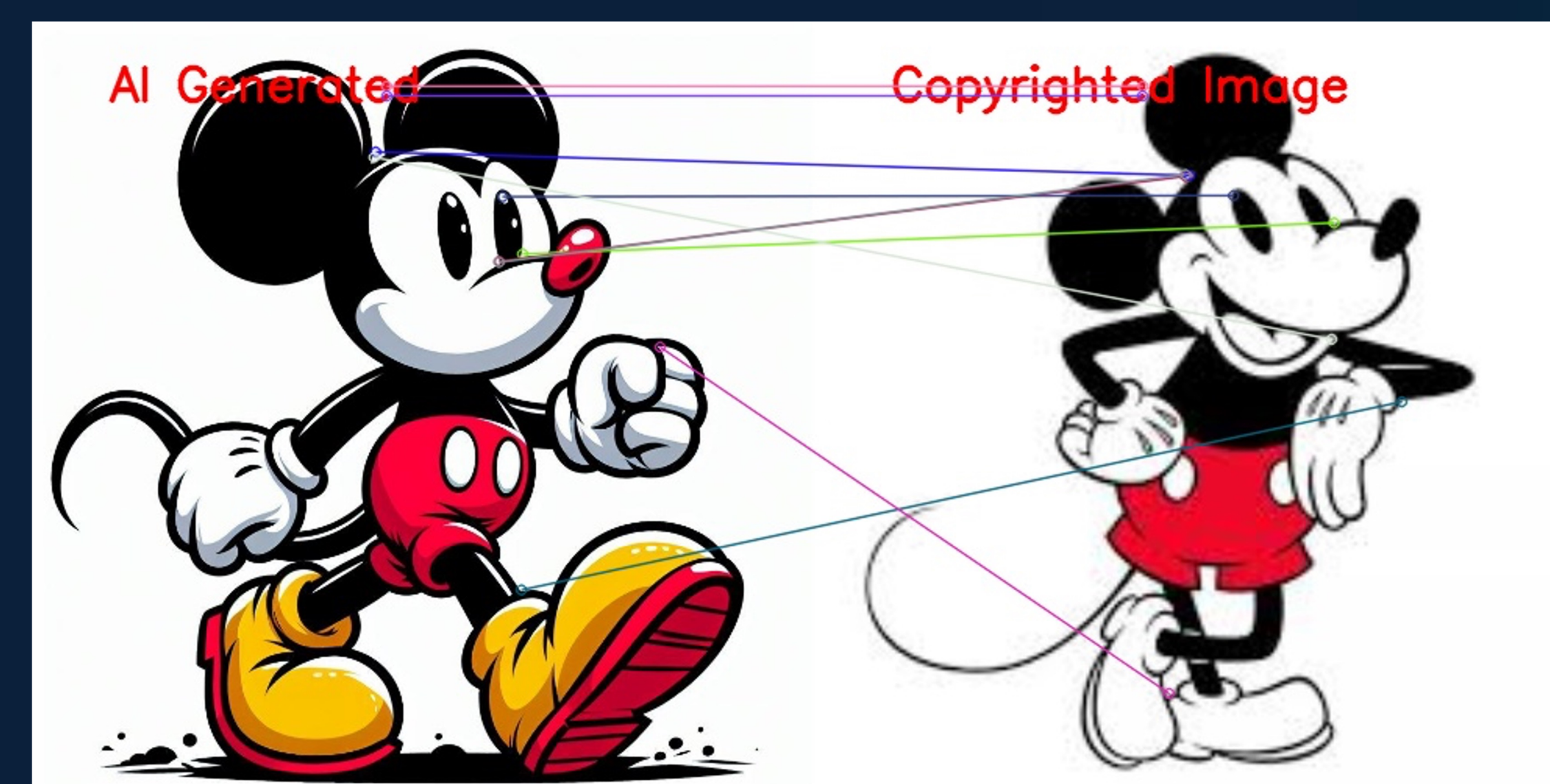
The focal point of this research is the quantification of copyright infringement specifically concerning image-generated content produced by AI. The study proposes four fundamental metrics for evaluating copyright infringement: SSIM, FSIM, RMSE, PSNR. Additionally, the research introduces a method for identifying points of interest within images, facilitating the matching of comparable features between AI-generated and copyrighted images to reinforce similarity scores.

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Keypoints

We showcase two images: one generated by a generative AI and the other a copyrighted image. Beyond assessing similarity scores, we propose identifying points of interest wherein comparable features between the images can be matched, thereby reinforcing our scoring system.



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