Deep Learning: Principles and practice
Course Projects-July to November, 2023

Steganography through Deep Learning

Guided By: Dr Shridevi S, Professor

Pallaprolu Pragnesh Kumar- 20BRS1097

Vemasani Varshini- 20BCE1240

ABSTRACT

This project explores deep learning-driven steganography, embedding and extracting diverse information in text, audio, video, and images. Leveraging convolutional layers, our approach ensures secure and imperceptible data concealment within image pixels. The project adopts a multi-modal strategy, training a versatile model to embed text, audio, video, and image data into images. Convolutional layers optimize the steganographic process, maintaining minimal visual or auditory distortion. Extensive training on large datasets enables the model to understand patterns in each modality. The embedding process strategically manipulates pixel values, ensuring minimal distortion. The model's ability to accurately extract concealed information is demonstrated, with evaluation metrics such as perceptual similarity and signal-to-noise ratio quantifying success across modalities. This research contributes a unified deep learning framework for concealing and extracting information from various media. Its applications span secure communication, digital watermarking, and covert data transmission, addressing contemporary data privacy and security concerns.

Background/motivation

In the digital age, where secure communication is vital, this project harnesses deep learning for advanced steganography. The goal is to covertly embed and extract information in diverse media (text, audio, video, images). Traditional encryption methods may leave traces, prompting the need for more sophisticated concealment techniques. Deep learning, specifically through convolutional layers, offers a powerful solution. The project aims to provide imperceptible information hiding and precise extraction, enhancing data privacy and security. Ultimately, this research contributes to advancing steganography's capabilities in safeguarding sensitive information in a variety of digital contexts.

Results

Our deep learning model excelled in multi-modal steganography, effectively embedding information within text, audio, video, and images. The process showcased high imperceptibility, underscoring the model's skill in minimizing distortion during steganographic modifications. Evaluation metric, such as perceptual similarity, consistently affirmed the model's proficiency across modalities, ensuring the concealed information's integrity within the pixel values of cover images.

Methodology

In text steganography, hidden messages are embedded within seemingly innocuous text by altering specific elements like word choice, spacing, or formatting. Audio steganography involves imperceptibly embedding data within audio files, manipulating frequencies or amplitudes to hide information. Video steganography employs similar techniques but within video files, exploiting frames or color channels to conceal data. Image steganography, hides information within image files by subtly altering pixel values and encoding the data with the cnn architecture.

Conclusion

In conclusion, this project propelled multi-modal steganography forward by harnessing deep learning and convolutional layers. The model demonstrated robust security, ensuring imperceptible information concealment in text, audio, video, and images. Results underscore the framework's versatility as a potent tool for secure communication and data privacy. This research significantly contributes to advancing privacy and security amid evolving digital challenges through innovative steganographic techniques. Future directions include refining the model architecture and exploring additional modalities to broaden real-world applications.