Image Tampering Detection Based on Steganographic Watermarking

Team 26

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Goal & Objective

- **Goal:**
  - Enhance the detection of tampered images to ensure authenticity and trust in digital content.

- **Objectives:**
  - Develop a solution using invisible watermarks to detect image tampering.
  - Provide a proactive method for verifying image integrity.
  - Enable users to identify manipulated visuals effectively.
  - Address critical concerns in digital forensics, journalism, and security by safeguarding the authenticity of visual data.
  - Contribute to the fight against misinformation and reinforce trust in digital media.

Source: Single-frame forensic watermarking for content authenticity

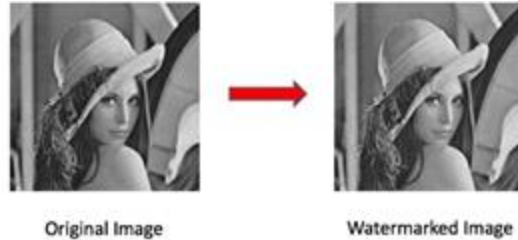# Current Methods & Potential Shortcomings

Current Methods

- **Spatial Domain Techniques**
  - Least Significant Bit (LSB) Embedding
- **Frequency Domain Techniques**
  - Discrete Cosine Transform (DCT)
  - Discrete Wavelet Transform (DWT)
  - Discrete Fourier Transform (DFT)
- **Hybrid Techniques**
- **Machine Learning-Based Techniques**

Potential Shortcomings

- **Balancing Robustness and Quality**
  - Image quality degraded
- **Handling Complex Edits**
  - Advanced tampering detecting
- **Processing Speed**
  - Real-time extraction efficiency

Proposed Approach

Original Image → Watermarked Image

Tampered Watermarked Image → Detection → Final Reconstruction
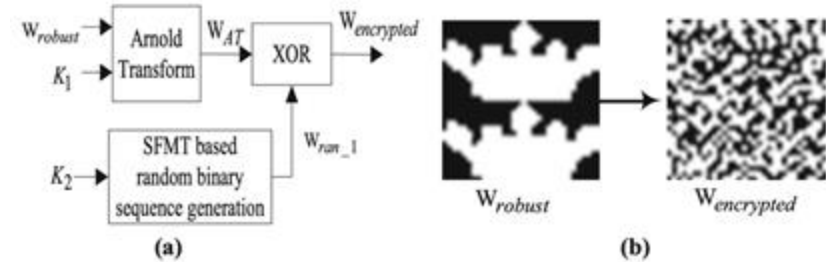

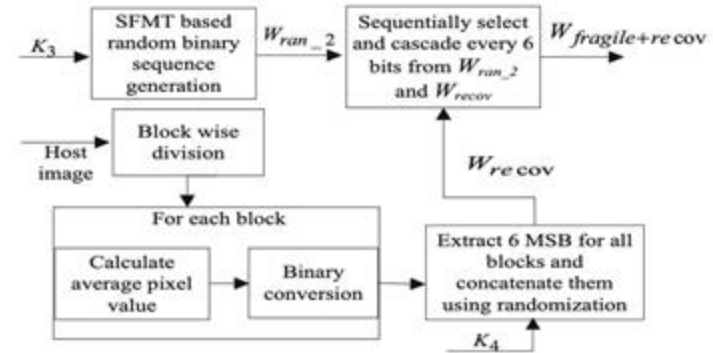Fig. 2 a Robust watermark preparation. b The robust watermark and its encrypted watermark

Fig. 3 Fragile watermark preparation in order to preserve the recovery data along with the authentication data

Source:
Fast fragile watermark embedding and iterative mechanism with high self-restoration performance

Source:
Multipurpose Image Watermarking: Ownership Check, Tamper Detection and Self-recovery

Preliminary Results

Preparation

Extraction

Evaluation

Embedding

Visualization

Test
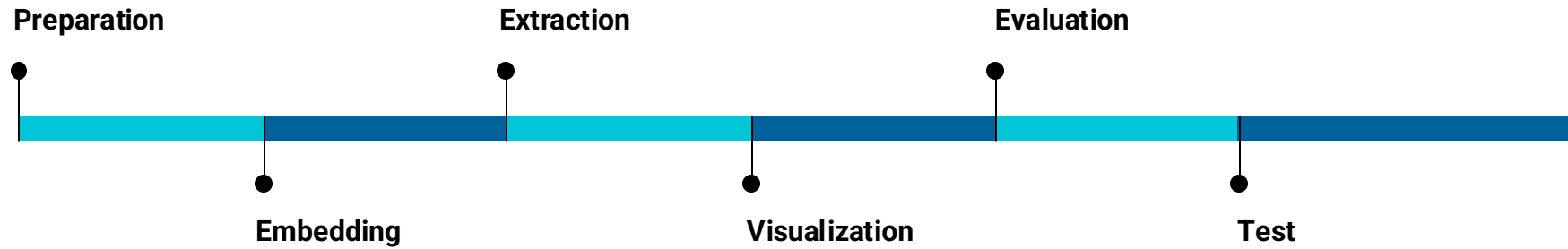
Preliminary Results

Original Image   Watermarked Image   Tampered Image   Tampered Detection

Summary & Future Plan

- **Summary**
  - The system framework and basic watermark embedding and extraction functions were successfully implemented.
  - The results show high image quality with an imperceptible watermark.

- **Future Plan**
  - Develop a robust watermark embedding mechanism.
  - Implement an image self-recovery function.