

A Comparative Study of Original and Altered Geo-Tagged Images for Forensic Image Authentication

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Received: 1st August, 2026; **Revised:** 5th August, 2026; **Accepted:** 8th August, 2026; **Available Online:** 20th August, 2026

ABSTRACT

Geo-tagged photographs, linked to a specific geographic location through the process of geo-tagging; which typically involves the assignment of at least latitude and longitude coordinates to the image, while additional parameters such as elevation, compass bearing, and other relevant fields may also be incorporated. The study constitutes comparative analysis of altered geo-tagged images and their original counterparts by extracting both external and internal data from the images. Individuals often encounter numerous challenges arising from the dissemination of location information associated with geo-tagged images, including their metadata and various modifications made to them. The sharing of EXIF data and associated metadata exposes individuals to risks such as stalking, blackmail, data theft, threats, and an array of other issues.

Keywords – Geo-Tagged Images, Image Morphing, Digital Forensic, Altered Photographs.

How to cite this article: Johari Tanushri1 Anita Yadav2*. A Comparative Study of Original and Altered Geo-Tagged Images for Forensic Image Authentication. Int J Drug Deliv Technol. 2026;16(86s):222-224. DOI: 10.25258/ijddt.16.86s.27.

Source of support: Nil.

Conflict of interest: None

INTRODUCTION

In this New age frequently use of mobiles, cameras, online platforms for capturing a photograph, videography, data transmission, messages and so many activities. With this drastic adoption of digital equipment gives new challenges like alteration, modification in images, Change the location, stalking, blackmailing etc. these geographical images contain a latitudinal and longitudinal values, these value gives a location information. The Latitudinal and longitudinal values are imaginary lines use for trace exact location on the earth. And the image also contains EXIF Exchangeable Image File Format data that data is consisting with the description like the date, time, location, capturing instruments, exposure settings. This metadata is very useful for the analysis of the altered images, reconstruct the crime scene, identify GPS location etc [1-3]. The geo tagged photos plays a very important role of digital evidence because these images consist with the Latitudinal and longitudinal values for location tracing with this the EXIF data is used for the identification; the growing trend of mobiles and social media has given bigger data of Figure: 1

GPS tagged images. It given the location information and help during the modern digital investigations. social media platforms frequently resize images, recompress files, or remove metadata during upload, and reduce the original content of the image [2-7].

METHODOLOGY

This study employed a comparative forensic analysis to examine morphed geo tagged images and establish their correlation with the original images. Each original image was paired with its corresponding morphed images and the examine based on different parameters. total 70 sample collected.

Parameters

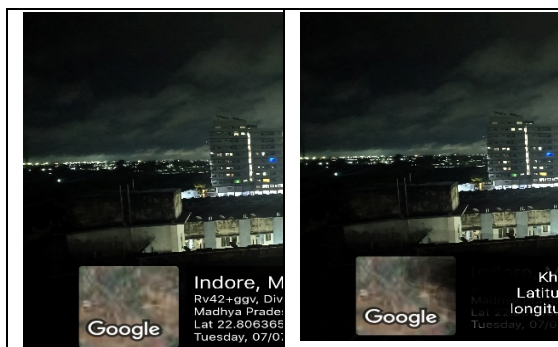
External/Visual Alteration

Image content, Visual appearance, Brightness, Contrast, Sharpness, Colour, Clarity

EXIF Metadata

Metadata availability, Camera make, Camera model, Date/time, Software, Image dimensions

Original Geo tagged Image & Altered Geotagged Image



Metadata Extraction

Figure: 1

ExifTool Version Number	: 13.55
File Name	: 11.jpg
Directory	: /mnt/c/Users/medha/OneDrive/Desktop/indore photos/Indore
File Size	: 650 KB
File Modification Date/Time	: 2026:08:11 16:09:04+05:30
File Access Date/Time	: 2026:08:20 18:23:15+05:30
File Inode Change Date/Time	: 2026:08:19 23:54:12+05:30
File Permissions	: -rwxrwxrwx
File Type	: JPEG
File Type Extension	: jpg
MIME Type	: image/jpeg
Exif Byte Order	: Big-endian (Motorola, MM)
Light Source	: Unknown
Orientation	: Unknown (0)
GPS Latitude Ref	: Unknown (0)
GPS Longitude Ref	: Unknown (0)
JFIF Version	: 1.01
Resolution Unit	: None
X Resolution	: 1
Y Resolution	: 1
Profile CMY Type	: sRGB
Profile Version	: 4.3.0
Profile Class	: Display Device Profile
Color Space Data	: RGB
Profile Connection Space	: XYZ
Profile Date Time	: 2016:01:01 00:00:00
Profile File Signature	: acsp
Primary Platform	: Unknown (0)
CMY Flags	: Not Embedded, Independent
Device Manufacturer	:
Device Model	:
Device Attributes	: Reflective, Glossy, Positive, Color
Rendering Intent	: Media-Relative Colorimetric
Connection Space Illuminant	: 0.9642 1 0.82491
Profile Creator	:
Profile ID	: 0
Profile Description	: sRGB

RESULT AND DISCUSSION

This study shows that alteration of the external visual characteristics of geo tagged images can produce detectable differences in selected EXIF metadata fields, total 70 samples are collected.

Table: 1

Sample	Sample	Image	Visual	Brightness	Contrast	Sharpness	Colour	Clarity
Extracted	Extrac	Content	Appearance	nes	as	ess	our	ty

The present study was conducted to the comparative evaluation of original and altered geo tagged images. Total of 70 samples, comparison 35 original and 35 altered images, were examined. The visual examination demonstrates clear differences between original and altered samples. And the EXIF examination provided additional forensic information. The comparison indicates that visual examination and EXIF analysis complement each other. Visual analysis can identify changes in the appearance or content of an image, whereas EXIF analysis can identify changes in the appearance or content of an image. The findings suggest that no single parameter used independently to establish image manipulation. A combined assessment of visual characteristics and metadata provides stronger forensic support for comparing an altered image with its original counterpart.

CONCLUSION

The present study successfully demonstrated the

		ent						
Original	35	35	35	35	35	35	35	35
Altered	35	35	35	25	24	22	27	26
Percentage of alteration	100%	100%	100%	71.4%	68%	62.9%	77.1%	74.3%

(Comparative Analysis OF External/

Visual Characteristics)

Table: 2

Sample	Sample	Metadata	Availability	Camera	Camera	Date/Time	Software	Image Dimensions
Extracted	Extrac	Availa	bility	make	model	me	re	nsions
Original	35	35	35	35	35	35	35	35
Altered	35	29	29	28	23	31	35	35
Percentage retained/consistent	100%	82.9%	82.9%	80.0%	65.7%	88.6%	100%	100%

(Comparative Analysis of

EXIF Metadata)

applicability of comparative visual and EXIF metadata analysis for examine altered geo tagged images. The comparison of 35 original and 35 altered sample revealed changes in the image content, visual appearance, brightness, contrast, sharpness, colour and clarity. And the EXIF examination further demonstrated that some metadata may remain change after visual manipulation, whereas parameter such as date time and software information. overall, the integration of external visual examination with EXIF metadata analysis can provide a more reliable basis for identifying image alterations and assessing image authenticity. The findings have potential applications in cybercrime investigation, digital image forensics, verification of geo-tagged evidence. Further research involving a larger dataset, different types of image manipulation, GPS-coordinate analysis, may improve the reliability and generalizability of the proposed approach.

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