Detecting Synthetically Generated Images

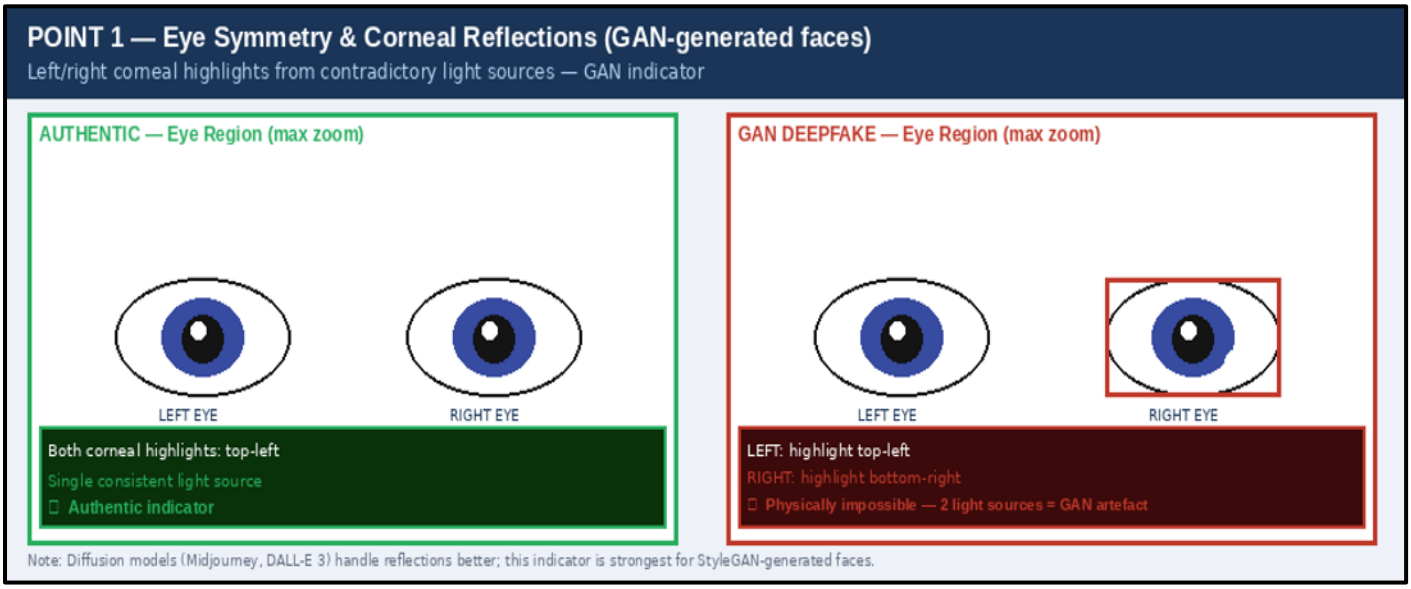
Preamble

AI-generated images using Generative Adversarial Networks (GANs) as well as diffusion models like Stable Diffusion, Midjourney and DALL-E 3 are now being used in practice by hostile actors for propaganda purposes such as fabricating atrocities, faking identities, making fake evidence and influencing online conversations. The ten advisory points below provides guidance on detection procedures that apply to GAN-generated and diffusion models-produced images.

Ten-Point Advisory

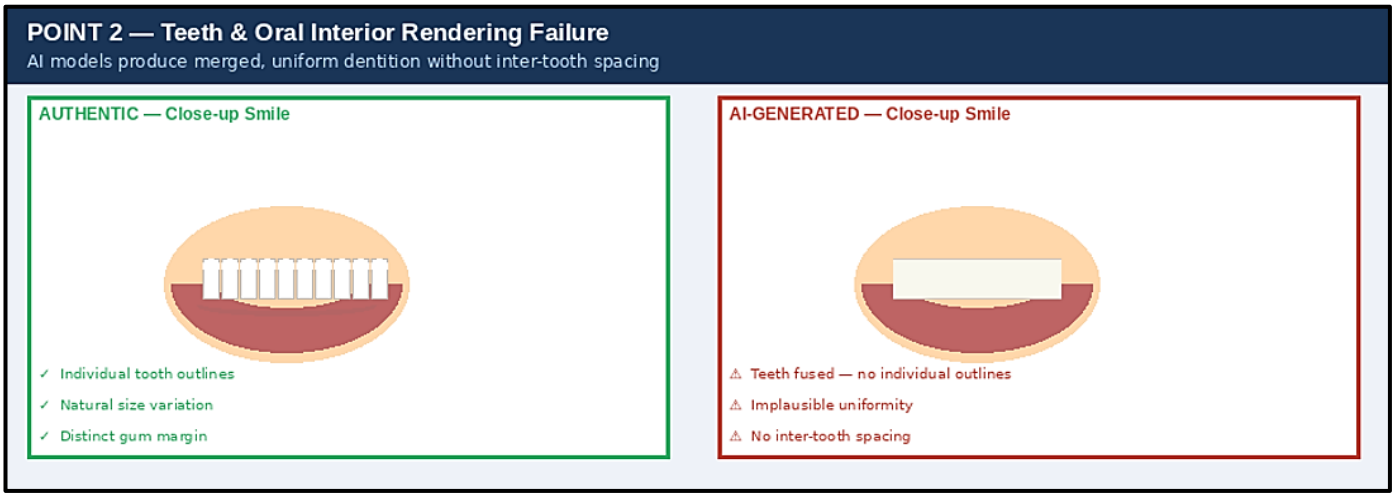
1. **Examine Eye Symmetry and Corneal Reflections**.

In the case of faces created using GANs (especially StyleGAN versions), there is often an inconsistency with regards to the source of light from which corneal highlights come, where one eye will show a highlight on its top-left side while the other eye will show a highlight in its bottom-right side and that cannot happen given only one source of light.



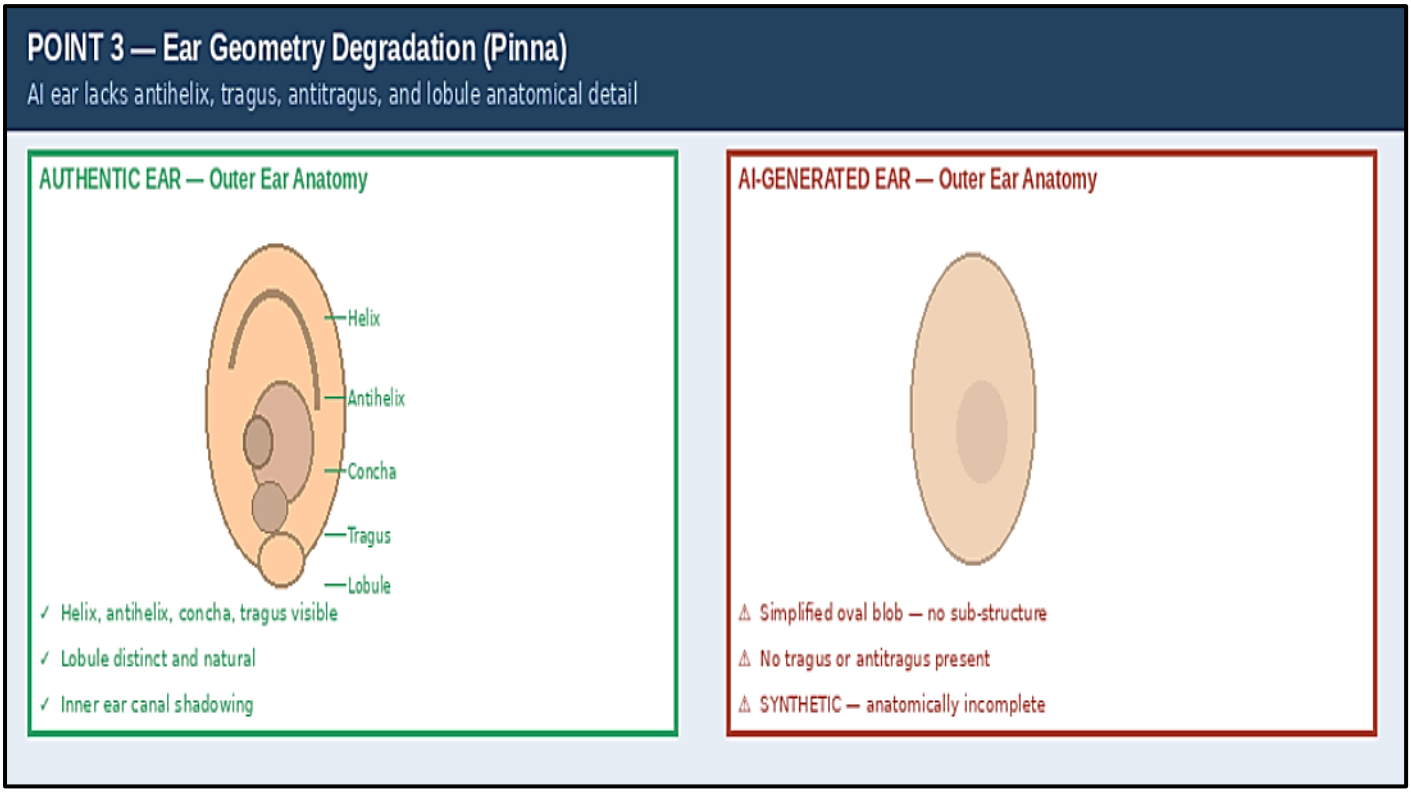
2. **Scrutinise Teeth and Oral Interior Rendering**.

The AI images that generate dentition do not allow for any inter-dental spaces between teeth, variation in gums and the true anatomy of the mouth. Each tooth may join together and form one solid mass without any borders between each tooth. Zoom in on the highest resolution to observe the difference.



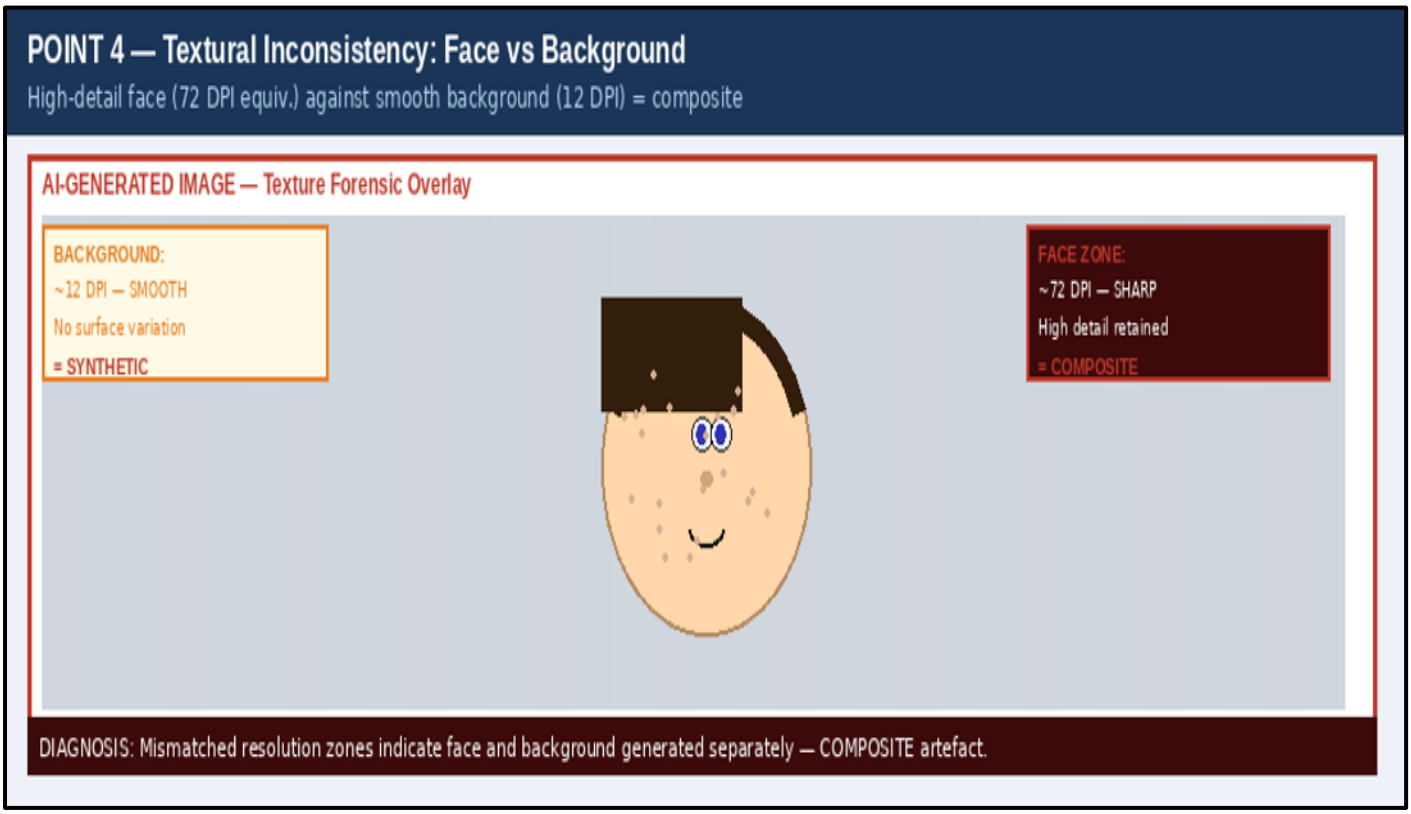
3. **Inspect Ear Geometry and Fine Anatomical Detail**.

Human ears are extremely intricate structures, with components like the helix, antihelix, concha, tragus, antitragus and lobule. However, AI ears always come out looking like an oval-shaped lump without any features such as the antihelix bend, tragus and lobule. Any ear showing this sort of uniform simplicity is definitely computer generated.



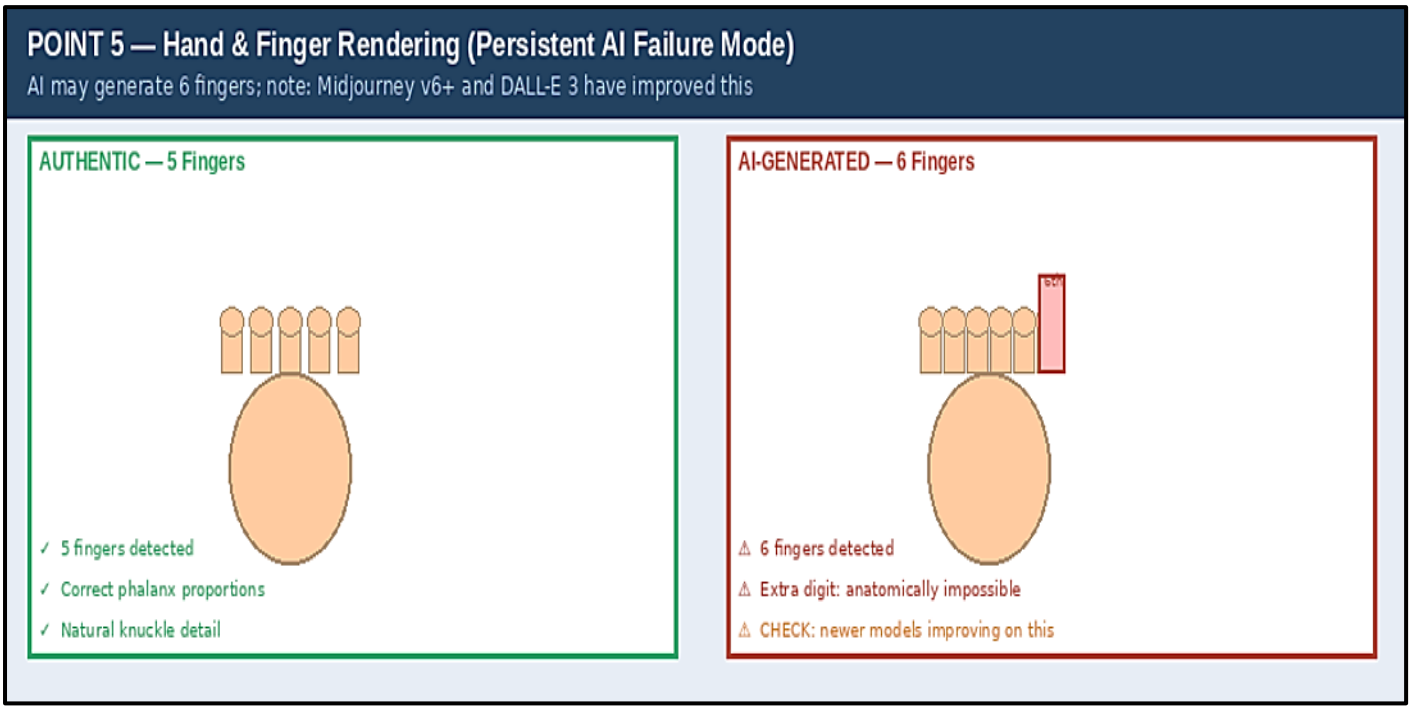
4. **Analyse Textural Inconsistency Across the Scene**.

AI-created composites will often show the feature of the face being extremely detailed while the background is extremely smooth and not very detailed at all – almost as though the face was created by itself and placed over another image. See if there is a correlation between the level of detail in the face with the texture of the background.



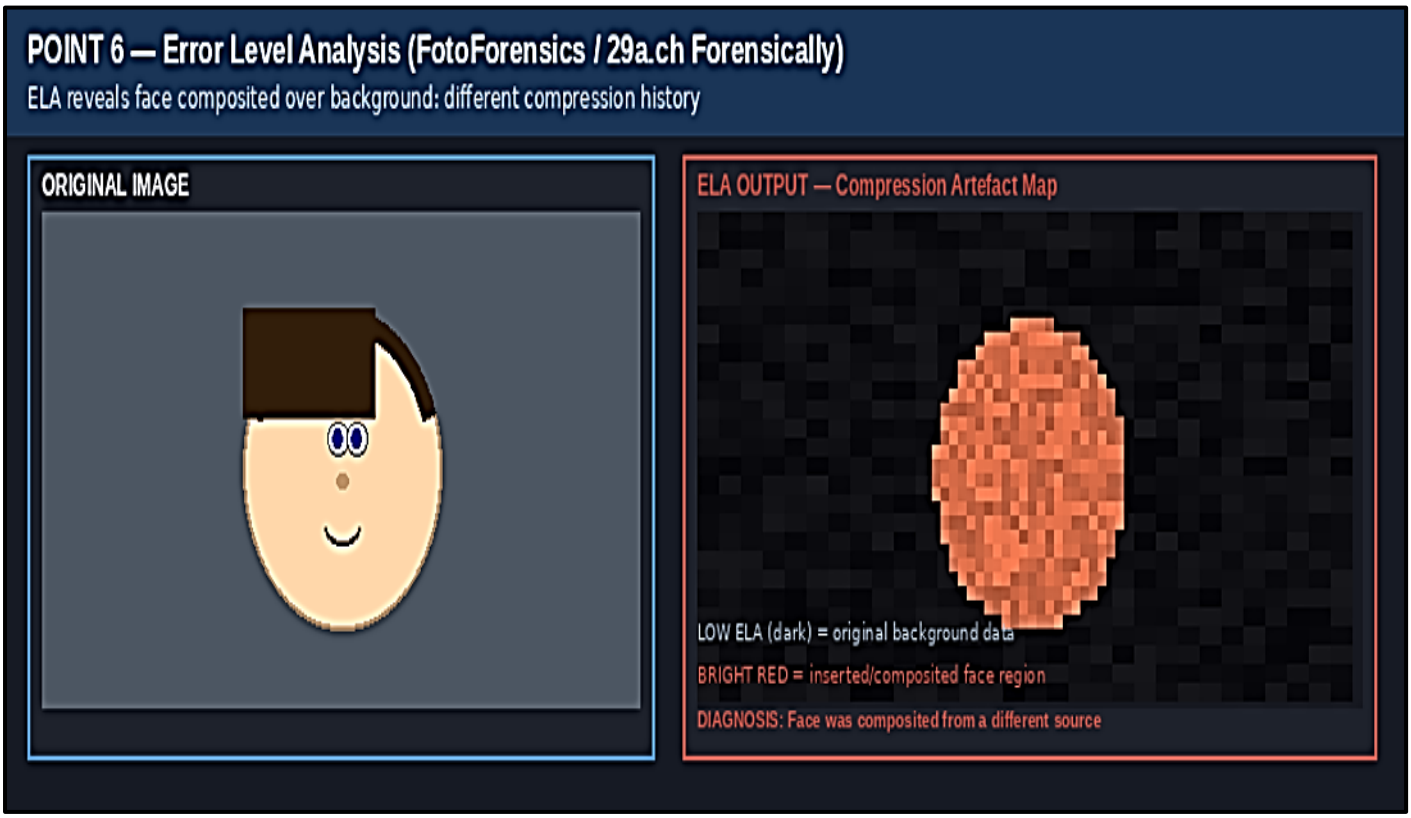
5. **Check Hand and Finger Rendering**.

Human hands continue to be an Achilles heel in generative AI. Count fingers (five per exposed hand), measure finger joint proportions, examine nails and observe skin folds at finger joints. Note: Midjourney v6 and DALL-E 3 (2024 onwards) generate better hands, but this test is crucial nevertheless. The presence of six fingers or webbed digits is a guaranteed AI signature in all AI models.



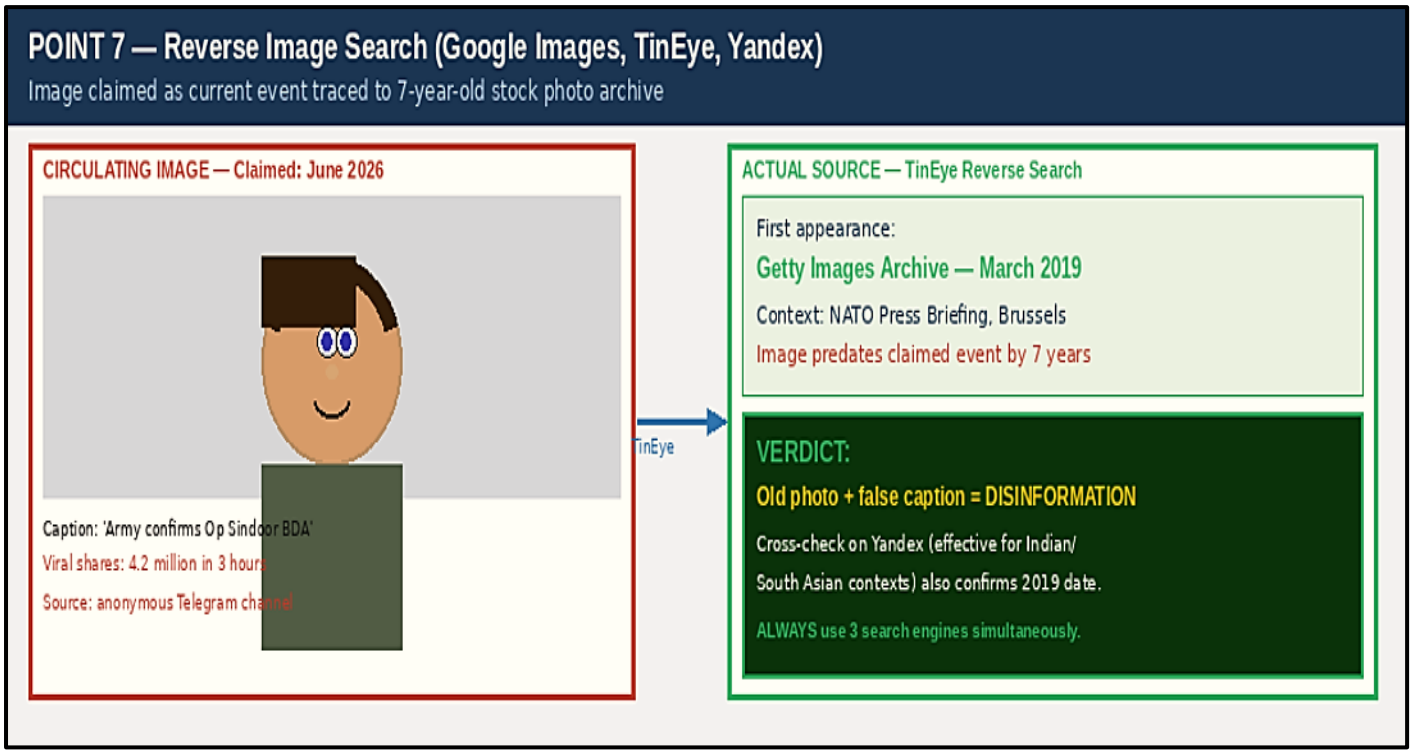
6. **Detect AI Spectral Fingerprints Using Frequency Analysis**.

Upload photos to FotoForensics (fotoforensics.com) using Error Level Analysis (ELA) or upload photos to 29a.ch/forensically for analysis in the frequency domain. Photos generated by AI have distinct features; the diffusion process creates distinct noise patterns and does not possess the double-compression feature of real photos. Photos generated by GANs show periodic peaks in spectra due to upsampling layers.



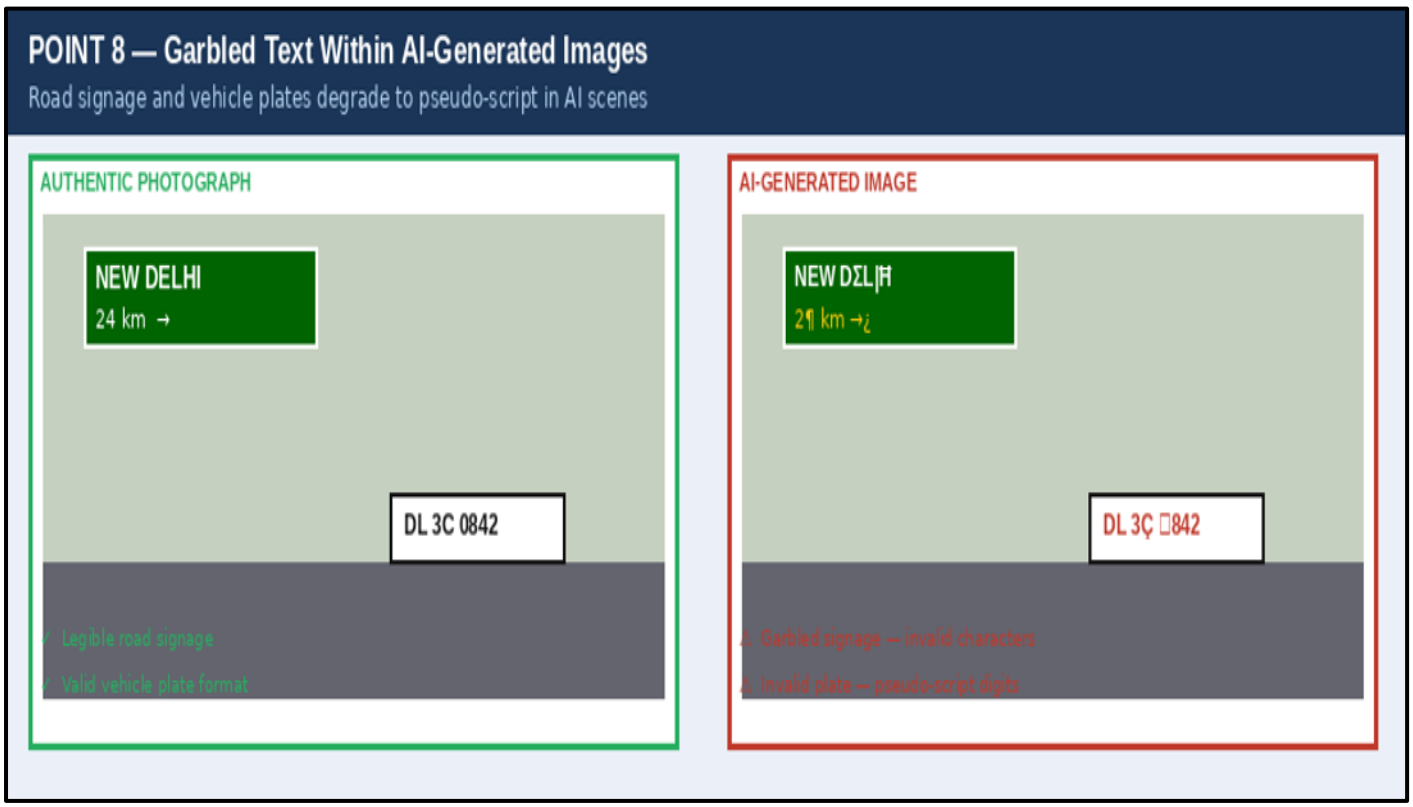
7. **Perform Reverse Image Search Across Multiple Engines**.

Search the same image in reverse simultaneously via Google Images, TinEye (tineye.com) and Yandex Images. Yandex is especially good at sourcing image results that relate to South/Central Asia contextually. A picture which is supposed to portray an ongoing event, but in reality is sourced from an old stock photo database, makes for direct proof of disinformation.



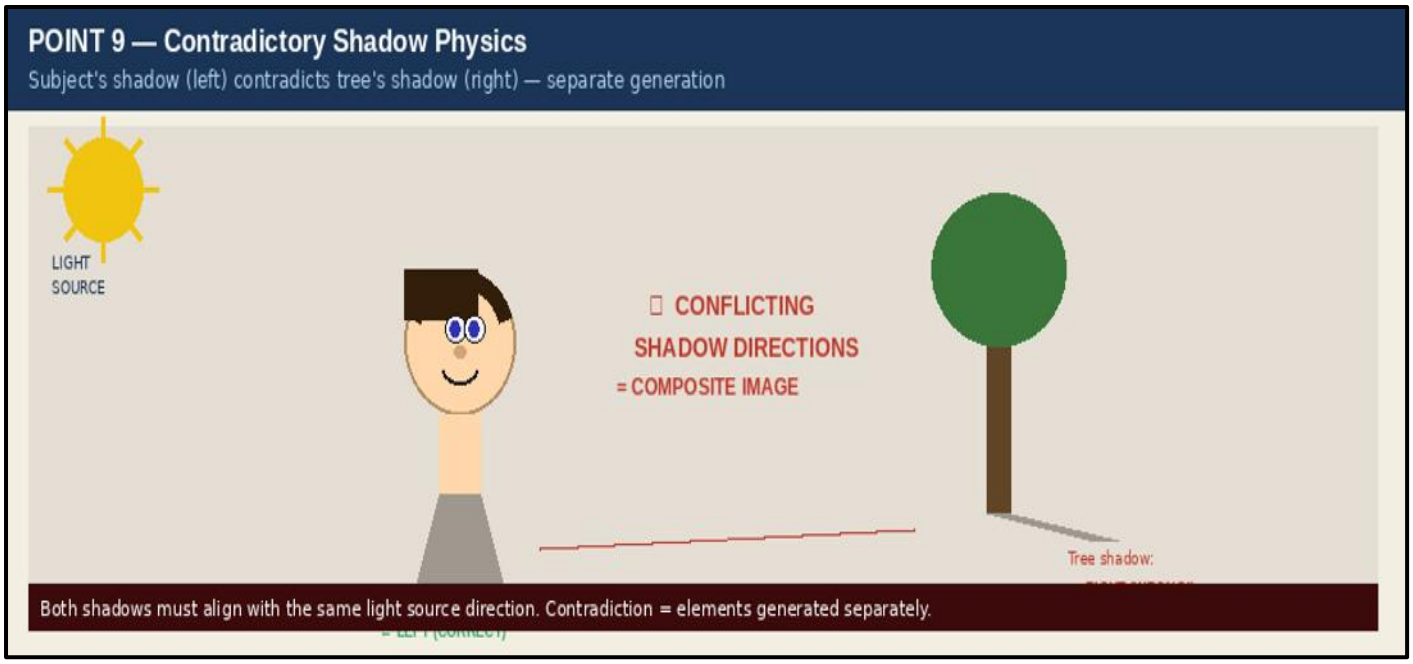
8. **Verify Textual Elements Embedded Within the Image**.

Image generators are always bad at drawing coherent text on an image. Look for all text elements in signs along the road, license plates on cars, badges, official documents, newspaper headlines. If they consist of scrambled letters, letters in multiple languages, incorrect format of license plates or pseudowords (sequences that look like words but aren't actual words), they are definitely generated by an AI.



9. **Assess Shadow Direction and Lighting Physics**.

Ensure that all shadows cast in the photograph follow the same direction or are derived from a real-world source of light. Shadows from AI-generated photos are typically inconsistent in direction; e.g., a person's shadow points toward the left-hand side whereas a tree's shadow on the same image points toward the right-hand side.



10. **Validate Through EXIF Metadata Extraction**.

Utilise either ExifTool (command line version), Metadata2Go (metadata2go.com) or pic2map.com for investigating the EXIF metadata tags. Note that Jeffrey Friedl's Exif Viewer service closed down permanently in 2023. Original photos have camera brand/model, lens focal length, aperture, shutter speed and usually GPS info included. AI-produced photos do not normally have any camera metadata included or else will list the AI application name used (Stable Diffusion, Automatic1111 WebUI, Midjourney) in the Software/Comment tags.