



Title: Enhancing Image Phylogeny Tree (IPT) Reconstruction through Local Editing Operation (LEO) Considerations.

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Abstract:

The growing prevalence of digital imagery has heightened the demand for robust techniques to authenticate and analyse images, especially as near-duplicate (ND) images increasingly circulate online. Recognizing how these ND images evolve

and spread has become vital, leading to research in reconstructing image phylogeny trees (IPTs). An IPT is a cyclic graph that illustrates genealogical connections between ND images, depicting parent-child transformations that reveal how images have been altered over time. Traditional IPT reconstruction methods are often computationally intensive and typically focus on global editing operations, such as compression, geometric adjustments, and color transformations. However, real-world images are frequently modified with complex local edits, like logo insertions, object removal, or splicing, making it challenging to accurately determine parent-child relationships.

To address these limitations, this study introduces an advanced IPT reconstruction algorithm incorporating a novel approach called "lines of editing." This technique refines the process of mapping ND image evolution, accommodating both global and local modifications more effectively. The proposed method enhances IPT reconstruction accuracy, benefiting digital forensics and image analysis by enabling better tracking of the origins and dissemination paths of modified images.

Employing systematic IPT reconstruction optimizes the analysis of large image datasets, facilitating the swift identification of altered images in cybercrime investigations and illegal content monitoring. In legal settings, IPT-based forensic methods offer a structured, scientifically validated approach that strengthens the credibility and admissibility of image evidence, providing detailed documentation critical for establishing tampering or manipulation. This improved

IPT framework enhances precision and reliability in a variety of investigative scenarios, making it a powerful asset in digital forensics

Biography

Dr. Sujata Kulkarni is serving in the field of teaching for the past 21 years at various levels. Presently she is working as Associate Professor in Electronics and Telecommunication department and IEEE Counsellor of IEEE SP-IT student chapter in Bhartiya Vidya Bhavans Sardar Patel Institute of Technology, Mumbai, Maharashtra, India. Dr. Sujata Kulkarni earned her postdoctoral degree from Swami Ramanand Teerth Marathwada University, Nanded, Maharashtra, India, in 2023, following her Ph.D. in Image Processing and Pattern Recognition from Yashwantrao Chavan College of Engineering, Nagpur, Maharashtra, India. Her expertise lies in Image Processing, Pattern Recognition, Machine Learning, and Artificial Intelligence. She visited to NIT Trichy, Singapore IECON 2023 in connection with presentation of papers in the international conference through travel grants received from CSIR. She has mentored numerous postgraduate students and Ph.D. scholars, focusing on innovative applications of Machine Learning and AI in agriculture, digital forensics, and multimedia. Dr. Kulkarni authored the book *Secure Biometric Authentication System and Applications* (LAP LAMBERT Academic Publishing, 2018; ISBN: 978-613-7-42818-4) and has published research papers in SCI and Scopus-indexed journals. She holds patents in agriculture and renewable energy and successfully led a funded project,

Smart Drone for Agriculture, with \$25,000 support from IEEE AESS DSTEL, completed in April 2024.

She has Organised more than 15 Seminars / Conference / workshop / FDP/STEM for engineering faculties and students which are sponsored by IEEE, AESS, CS. She has published more than 80 papers in the national/international journal and conferences. She is member of the Institute of Engineers (India), ISTE and IEEE, AESS. Her research contributions have been recognized with the **Best Paper Award** at the International Conference on Advances in Engineering and Technology for her work on Analysis of Seismic Signal and Detection of Abnormalities and Finger Vein Recognition.

Dr. Kulkarni is an esteemed Life Member of the Indian Society for Technical Education (LMISTE, No. LM55790), a Senior Member of the IEEE (95624273), and maintains active memberships in IEEE AESS, GRASS, CIS, and IETE (Membership No. M500728). Her dedication to advancing technology across disciplines highlights her impact on Machine Learning and AI applications in diverse and essential fields.