National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Image Forensics: Towards Effective Techniques for Image Authentication in Compressed Domain
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Venue	: ECE Seminar Hall (Room No. EC 303)
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Abstract	: Image forensics forms an important sub-domain in the broad domain of information forensics since most images are either tampered with in an uncompressed or compressed scenario and can spread fake news among social media. It has various applications: surveillance, navigation, commercial and non-commercial, advertising, political, etc. It has several challenges: court-level privacy issues, scalability, lack of hardware equipment, and multiple manipulations. Due to the popularity of JPEG as a compression standard, the importance of detecting manipulation in JPEG images has increased. Many data-driven approaches are implemented to detect manipulation of uncompressed scenario however, the performance degraded significantly in re-compressed images due to lossy compression. One such research problem is the detection of manipulation and its further classification into altered/unaltered, which are the focus of the current work. This manipulation detection and parameter estimation can have many applications like localizing abnormal/important activity, spreading fake news, etc. Two novel techniques addressing this problem i.e, detection of resampling (altered v/s unaltered) and estimation of manipulation parameters, are investigated in this work. Firstly, a novel application of power spectral density using the Bartlet method is explored for the resampling detection to extract clues and its further classification using machine learning algorithms in the case of JPEG compressed images. Secondly, a method based on application of a deep convolutional neural network is proposed for the same objective, by analyzing the blocking artifacts and suppressing them to enhance resampling clues in compressed domains. Both methods achieve superior performance compared to the state-of-the-art baselines, precisely the most challenging case with lossy post-JPEG compression. Later the thesis focused on the under-explored manipulation operator chain classification problem, which entails recognising complex manipulations like Gaussian blurring and resampling. A dual-stream residual network (ReMReNet) using ResNet as a backbone is proposed for JPEGresistant image operator chain detection. ReMReNet consists of noise residual extraction (NRE) and compression feature extraction (CFE) streams for better results against JPEG compression.