

Image Splicing Detection Algorithm

Hawraa Sabah Naser

Publication Date: 2025/10/14

Abstract: In present time where most of information and data around the world become digital in every field such as news and with all these programs, tools, artificial intelligence that used to edit , manipulate , change, forgery in images and videos it is become harder to detect these changes especially the one that used to forgery .this paper present image splicing method to detect changes in image by using Ycbr format , predict-error edge detection and for preprocessing enhance the image using Curvelet transform to reduce the noise [1].

How to Cite: Hawraa Sabah Naser (2025) Image Splicing Detection Algorithm. *International Journal of Innovative Science and Research Technology*, 10(10), 631-634. <https://doi.org/10.38124/ijisrt/25oct103>

I. INTRODUCTION

The biggest share and storage data in the internet in various social programs are images and videos which means there is so much editing and manipulating that been shared between people which used for different purpose for influence , control or just for fun [2] . there are so many tools , methods , programs that used to make the changes in the images :- copy-moving some parts of images , delete person or object , blur , covering ,inserting etc. these changes in image cause some duplicates or inconsistency of lighting in image. Image splicing detection methods divided to two category : active method which happen due the image creation such as put a signature or water mark on the image that help us to authenticate the image by tracking these features . the second category is the passive method that used by copy –moving , delete and etc which the paper mention before [3] .

II. FEATURE EXTRACTION

Spliced image always has changes in the image structure because of methods that used on it to make the desire changes , these changes effect the sharp edge of the objects in the image , so if we can detect these edge changes it can be clue to know the authenticate of the image and detect the splicing in it there is different technique to extract these feature of image which is chroma channel [4].

➤ Color Space

The format of the image this paper going to use is Ycbr format, which is color space like the RGB format but use different color presentation , where Y refer to luminance component of the format ,while the cb is the blue one and cr the chroma component. Lots of image content located in Y and the rest in cb, cr [4]. Some of image splicing detection technique use the Y component which it useful to detect the splicing images [5] .

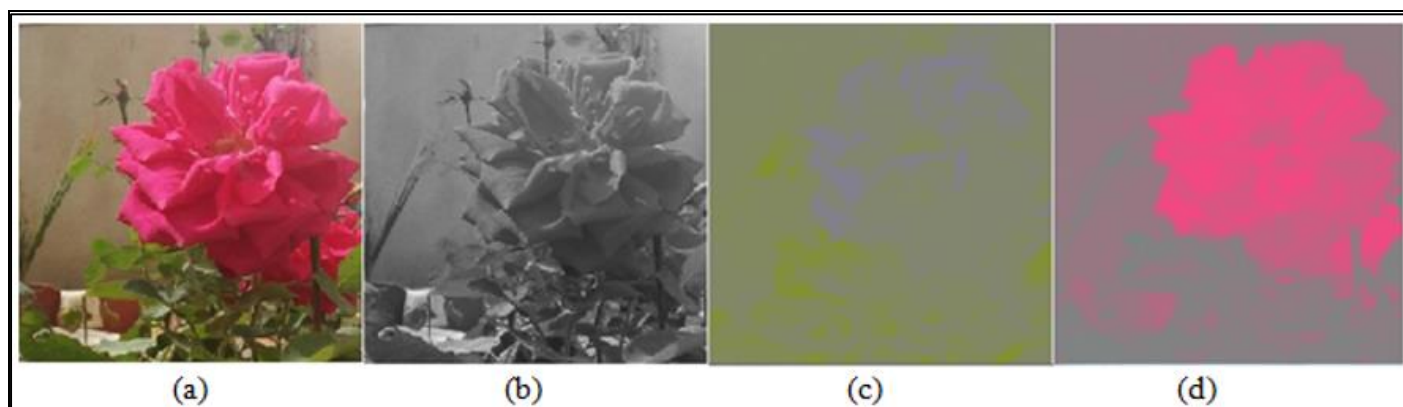


Fig 1 (a) Example of Authentic image in RGB Format (b) Ycbr Component (c) Cb Component (d) Cr Component

➤ Image Enhancement

The main goal of enhancing is to make an image that more serviceable to use in any method and easier to process and analyze, by make the image in better resolution, extract the information to make the image perception more accurate [6][7].

➤ Curvelet Transform

The Curvelet transform developed by Candes and Donoho and it has been used for enhance the limitation of the wavelet transform. This method suitable to process the wave data because of its ability to obtain full spectral information of an image with different directions of image edges [8]. So, curvelet transform is considered a good filter to enhance and denoise the image.

The curvelet transform overcomes wavelet transform in following:-

- Edge and Wave representation.
- Elements directions dependent on scaling.
- High anisotropic elements.
- Image reconstruction.

➤ Edge Detection

To reduce the effect of residual image content in image component cb or cr an edge detection method is going to be

used, there are many different methods and technique such as sobel, canny, log, etc. This paper used the edge is predict-error method which is four edge image denoted by $Edge_h$, $Edge_v$, $Edge_d$, $Edge_{-d}$ these four edges are generated by this method (predict-error) as following[4]:

$$E_h(i, j) = |x(i+1, j) - x(i, j)|$$

$$E_v(i, j) = |x(i, j+1) - x(i, j)|$$

$$E_d(i, j) = |x(i+1, j+1) - x(i, j)|$$

$$E_{-d}(i, j) = |x(i+1, j-1) - x(i, j)|$$

Where $x(i, j)$ is the indicates gray value of the pixel at location (i, j) [4].

Before using the predict-error method the image should be used de-noise technique to enhance the feature and reduce the noise to give more accurate result and also the edge detection predict-error method is consider sensitive to the noise the technique that used in this paper is Curvelet as mentioned before.



Fig 2 An Example of Spliced Image (a) RGB Spliced Image (b) Ycbr Spliced Image (c) Edge Detection

Figure (2) the spliced image that used to compare between the component of Ycbr that clearly show that most of the edges in original and spliced image in the Y component, in the other side the edges in cr, cb are smooth in authentic image more the ones in the spliced image that could help the authenticate the images[5][10].

➤ Gray- Level

The gray level co-occurrence matrix (GLCM) method is used to extract second order texture feature from the edges of the image in cr, cb component, the gray level co-occurrence matrix (GLCM) use the gray level pairs of the image most of the gray value in cb, cr component are below 10 so a threshold method will be used as following[10]:

$$e(i, j) = \begin{cases} e(i, j) & , e(i, j) < T \\ T & , e(i, j) \geq T \end{cases}$$

Where (i, j) is the location and e is the value, after the threshold process the gray level co occurrence matrix are four, the matrix size is $(T+1) * (T+1)$ of the edge:

1. CM_h is $P(E_h(i, j), E_h(i, j+1))$.
2. CM_v is $P(E_v(i, j), E_v(i+1, j))$.
3. CM_d is $P(E_d(i, j), E_d(i+1, j+1))$.
4. CM_{-d} is $P(E_{-d}(i, j), E_{-d}(i+1, j-1))$.

These four matrix generate feature for each matrix by transform it to vector then turn it to one feature vector where the length of it is calculated by this equation $4*(T+1)*(T+1)[4]$.

➤ BFS

To reduce the complexity of training and testing, A method is applied (Boosting Feature Selction(BFS)) this method select optimal feature and used for reduce dimension , improve the detection accuracy . after N number of iterations we get N-dimensional new feature vectors that will used in the classification[3].

➤ Classifier

Support Vector Machine (SVM) is functional classifier that used in this paper is LIBSVM a library of support vector machine is used to classification[4] .

➤ Detection Performance

In this experiment we chose N=25 , 50 , 70 , 100 for the BFS algorithms the image that used as training sample are chosen randomly (250 authentic , 250 spliced) images, the training of the classifier , RBF the parameters C and γ are selected by grid searching , after every run a different threshold and dimensions are used , to demonstrate the effect of the BFS [4][11] .

III. RESULT

Table 1: Experiment result of the proposed method

Accuracy		N=25	N=50	N=75	N=100	No BFS
T=7	Y	67%	67%	68%	69.4%	62%
	C_b	85%	83%	82.6%	90%	88%
	C_r	86%	87%	88%	89%	89%
T=8	Y	75%	77.3%	79%	80%	70%
	C_b	80%	85%	83%	89%	75%
	C_r	81%	84%	87%	88%	77%
T=9	Y	66%	77%	79%	82%	80%
	C_b	84%	87.3%	90%	91%	84%
	C_r	89%	86%	89%	90%	82%

The dimension of the no BFS is 256, 324 and 400 for T=7 , T=8 , T=9 , from the table 1 feature extract from the component C_b , C_r perform better than Y , the validation of BFS is approved the highest accuracy rate is 91% on C_b on the threshold T=9 and dimension N=100 .

IV. CONCLUSION

This paper suggest a passive color splicing detection method by using the analysis of image chroma component. The experiments of the method show the effect of using the Ycbr format and boosting feature selection and use of the four edges detection and vectors help to improve the result .

FUTURE WORK

In future work we suggest to use different edge detection method to compare the result of the different method , also use another preprocessing technique to study the effect of this step on the final result .

REFERENCES

- [1]. Thales pomari, guillherme Ruppert, Edmar Rezende,Anderson Rocha, Tigo Carvalho,"IMAGE SPLICING DETECTION THROUGH ILLUMINATION INCONSISTENCIES AND DEEP LEARNING" IEEE, 2381-8549 , 2018.
- [2]. Shivani Tufchi, Ashima Yadav, Tanveer Ahmed, "Advanced Multi-Model Approach for Robust Image-Based Fake News Detection: A Comparative Study of Different Image Models", 2024 15th International Conference on Computing Communication and Networking Technologies (ICCCNT), pp.1-7, 2024.
- [3]. Davide Cozzolino, Giovanni Poggi, Lusia Verdoliva, "SPLICERBUSTER: ANEW BLIND IMAGE SPLICING DETECTOR", 2015 IEEE International Workshop on Information Forensics and Security (WIFS) (2015): 1-6.
- [4]. Wei Wang, J. Dong and T. Tan, "Effective image splicing detection based on image chroma," 2009 16th IEEE International Conference on Image Processing (ICIP), Cairo, Egypt, 2009, pp. 1257-1260, doi: 10.1109/ICIP.2009.5413549.

- [5]. Belal Ahmed , T.Aaron Gulliver , Saif alZahir , "Image splicing detection using mask-RCNN" springer , 2020.
- [6]. Nikolas Galatsanos, Andrew Segall, Aggelos Katsaggelos, "Digital Image Enhancement," Encyclopedia of Optical Engineering, pp. 388-402, 2003.
- [7]. Sahera Abued Sead Almola, " REVIEW IN IMAGES ENHANCEMENT MEDICAL USING CURVELET TRANSFORM AND VECTOR INFORMATION ", Iraqi Journal of Intelligent Computing and Informatics (IJICI), Vol. 1, 2, December 2022, pp. 107~118 .
- [8]. D. Mary sugantharathnam, Dr. D. Manimegalai, "The Curvelet Approach for Denoising in various Imaging Modalities using Different Shrinkage Rules," International Journal of Computer Applications, Vol. 29, No.7, pp. 36-42, September 2011.
- [9]. K. Zhang, Y. Liang, J. Zhang, Z. Wang and X. Li, "No One Can Escape: A General Approach to Detect Tampered and Generated Image," in *IEEE Access*, vol. 7, pp. 129494-129503, 2019, doi: 10.1109/ACCESS.2019.2939812.
- [10]. Wei Wang, Jing Dong and Tieniu Tan, " IMAGE TAMPERING DETECTION BASED ON STATIONARY DISTRIBUTION OF MARKOV CHAIN", National Laboratory of Pattern Recognition, Institute of Automation, Chinese Academy of Sciences, P.O. Box 2728, Beijing, P.R. China, 100190
wwang, jdong, tntg@nlpr.ia.ac.cn