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Mosaic Image Creation in Video for Secure Transmission

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Abstract – *In today digital world the availability of the internet has made world a small place due to which a large amount of data is exchanged between the users in different forms, such as Text files, Image files, Video, Medical reports important files of defense, And bank statements etc., the security and reliability of the data is an important aspect behind this. In this paper we purpose a new method for securely transmission of image over the medium using Mosaic image creation in video for secure transmission. The mosaic video looks similar to the selected Source image (Target Image) which is one of the frames of the video, and may be used as camouflage of the secret image. The information required for recovering the secret image is embedded into the video, into the created mosaic image by lossless data hiding using a key.*

***Key Words*: Steganography, Mosaic, Data Hiding, RCM, Watermarking.**

1. INTRODUCTION

Now a days, in time spaced world transfer of data over the digital medium is done on large scale due to the fast availability of internet and the advantage of getting the data in fraction of second, but the security of data is an important part, if file is lost or hacked it may lead to many problems socially or personal. The common approaches used are image encryption and data hiding, both the techniques have some advantages and disadvantages. Existing data hiding method mainly apply LSB sub situation, Prediction error expansion, histogram Shifting and others [3]. We have studied the different data hiding techniques such as watermarking, Steganography, cryptography the details are explained in literature survey. Here in this manuscript we have proposed a technique for data hiding using Mosaic Image creation in video. Data hiding and Mosaicing of images have been in use since long before use of digital computers. After the photographic technique was developed, the use of photographs was determined on topographical mapping [5]. Mosaic is a type of artwork assembled by composing small pieces of materials, such as glass, stones, tile, etc. Invented in aged time, are still used in many purpose today. Creation of mosaic images by computer [1] we will try to explain in four parts:

1. Introduction, 2.Literature survey, 3.Methodology, 4.Simulation 5. Results.

2. LITERATURE SURVEY

We studied various research and journal paper related to data hiding technique and transmission over the medium; here in this part we will compare authors and there techniques and the results.

Mehmet U. Celik, Gaurav Sharma Lossless embedding technique for data hiding are used a long way back one such technique is LSB modification where each sample of signal is replaced by payload data and in extraction process these are read in the same process of scanning and embedded payload data is reconstructed. The lossless technique is mainly classified into two types: first type involves additive spread spectrum technique, where signal is superimposed on host signal in embedding phase. This algorithm is robust in nature. The second type involves modifying of information bits which are embedded at selected features of the host signal. The authors here purpose a novel technique for Reversible Data Hiding, the scheme provides high embedding capability which allows complete recovery of host signal and small distortion is introduced between host and image bearing the embedded data. In required application which requires high capacity the technique can be modified to embedded level to meet capacity required system. In many systems the embedded information creates distortion which is by far less yet irreversible. Which can`t be removed or recover the original host signal. This demands the need for lossless data embedding scheme, the proposed scheme insert information by modifying the host signal which also induces distortion. This technique enables the removal of distortion and lossless recovery of original host signal.

The result shows that this technique provides lossless recovery of the original signal as well as provides high embedding capacity.

Hirdesh Kumar and Awadhesh Srivastava The security of data in today's era is an important part to safeguard the data from all would be happen things for data we use different techniques to provide security, the different scheme are key safeguarding, cryptography and encryption which are the vital aspect for data protection. Key safeguarding and encryption techniques are used to secure data until correct key is typed to recover data; the disadvantage is it may be used maliciously. Secret sharing is technique where secret data will not reveal any information about secret data using deformation technique and will reformed by qualified subsets of shares are met. The author has proposed an new color image security scheme which is combination of deformation and reformation algorithm for color image. The technique is based on safeguarding of key and secret sharing scheme. Here the secret color image is used to generate the key image from matrix calculation the system is divided into two parts: Deformation and Reformation side. In the deformation algorithm the secure key is generated and pixel from secret and securing image is used to calculate the value of key and value is stored in two pixel values. In reformation side any securing and key image is selected and the values of pixel are retrieve, the values of securing image is subtracted from the key image and are applied to retrieve pixel of secret image.

The result obtained from the proposed method are more secured and efficient, the security is higher than the single scheme for secret sharing or key safeguarding and the secret image are recovered without distortion.

Table -1: Table of Comparison

Sr. No	Title & Year of Publication	Authors	Technique Used	Result
01	Data Hiding in Images by Adaptive LSB Substitution Based on the Pixel Value Differencing IEEE 2006	Suk-Ling Li , Kai-Chi Leung, L.M. Cheng, Chi-Kwong Chan	LSB Substitution Based on the Pixel Value Differencing	The PSNR value and embedding capacity are better than schemes
02	Reversible data hiding IEEE 2006	Zhicheng Ni, Yun-Qing Shi, Nirwan Ansari, and Wei Su	Reversible data hiding	The technique is able to embed about 5-80 kb in 512x 512x8 grayscale image
03	A Secret Sharing Scheme for Secure Transmission of Color Images IEEE 2014	Hirdesh Kumar and Awadhesh Srivastava	Deformation and reformation algorithm for color image	The secret image is covered without distortion
04	Secret-fragment-visible mosaic image—A new computer art and its application to information hiding IEEE 2011	I. J. Lai and W. H. Tsai	Image Mosaicing	Create a secret fragment visible mosaic image by fragmentation technique to better data security by Mosaic Image Creation Algorithm.
05	A new secure image transmission technique via secret-fragment – visible mosaic image by nearly reversible color transformations IEEE 2014	Ya-Lin Lee and W.H. Tsai	Image Mosaicing	Create a secret mosaic image and eliminates drawback of database required in previous technique.

3. METHODOLOGY

A new technique for secure image transmission, i.e. a new type of computer art image called secret fragment visible mosaic image is proposed by Lai and Tsai. Mosaic which is created automatically by composing small fragments of a given image to become a target image in a mosaic form, achieving an effect of embedding the given image visibly but secretly in the resulting mosaic image. In this method the target image which is required to hide the secret image has to be preselected from a data base. Which is a weakness of this method and another limitation for this method was that only image transmission was possible, not Video. To resolve this issues a new method is introduced which can be used to transmit video.

The proposed method includes two main phases

1) Mosaic video (image) creation and

2) Secret video (image) recovery.

3.1 Module Description

The user has to select a video (AVI) which would be used as source file and upload it. It is followed by decompressing or resizing the video frames into the range between 800x800 to 1028 x728 pixels format, here we will use 1028x728 pixel format .After obtaining all frames from the video (20f per seconds, it depends upon the user to select the number of frames), the frames are saved in a database and later used for reference while selecting a target image. Also the user is required to upload any one secret image depending upon the likes of the user.

Here the proposed method is divided into two parts

1. Mosaic video creation (sender side).
2. Secret image recover from video (receiver side).

Part I: Mosaic Video Creation

A. Transformations of color between Blocks

In the first phase of the proposed method, the user has to selects a secret image and target image then split into tilt images. Here we have to perform color transformation of entire tiles pixel. If the size of target and secret image is different from other user has to change it to desired or identical size. Each tile image T in the given secret image is fit into a target block B in a preselected target image. The color characteristics of Target T and block B are different from each other, how to change their color distributions to make them look alike is the main issue here. Reinhardt al. proposed a color transfer scheme in this aspect, which converts the color characteristic of an image to be that of another in the l**α**β color space. More specifically, let T and B be described as two pixel sets for secret image and target $\{p_1, p_2 \ldots p_n\}$ and $\{p_1', p_2' \ldots p_4'\}$, respectively. Let the color of each p_i be denoted by (r_i, g_i, b_i) and that of each p_i' by (r_i', g_i', b_i'). At first, we have to compute the means of T and B, respectively, in each of the three color channels R, G, and B and standard deviations of each tile image

$$\mu_c = \frac{1}{n}\sum_{i=1}^{n} c_i, \quad \mu_c' = \frac{1}{n}\sum_{i=1}^{n} c_i'$$

$$\sigma_c = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(c_i - \mu_c)^2}, \quad \sigma_c' = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(c_i' - \mu_c')^2}$$

In which c_i and c_i' denote the C-channel values of pixels p_i and p_i', respectively, with c = r, g, or b and C=R, G, or B. Next, we compute new color values (r_i'', g_i'', b_i''). For each p_i in T by

$$c_i'' = q_c(c_i - \mu_c) + \mu_c',$$

To compute the original color values (r_i', g_i', b_i') of p_i from the new ones (r_i'', g_i'', b_i''), we use the following formula which is the inverse of

$$c_i = (1/q_c)(c_i'' - \mu_c') + \mu_c.$$

Know creating a mosaic image M by fitting the tile image into the corresponding target image blocks accordingly and embedding sufficient information about the new tile image for recovering stage.

The next part of the stage is an important here we have to select the appropriate target block and to fit rotating blocks with smaller RMSE value, the color characteristic of a tile image T to be that of a corresponding target block B.

After conducted color transformation some pixel values in the T' new tile image might have overflow (If the range goes beyond the most positive or most negative largest number, this is called an 'overflow'.) /underflow (If the number is too tiny to be represented, this is called an '**underflow**') value so we convert all this values to non-overflow or non-underflow one and record all value difference for later recovery process. The next step is to embed the information for secret image recovery and re-build video, we have to embed relevant information into the mosaic image, here we use method proposed by Coltuc and Chassery and apply to LSB of the pixel in the created image to conduct embedded data. The method conduct forward and backward integer transformation in which (x, y) are pixel value and (x', y') are the transformed ones. This method yields high data embedding capacities.

The data (information) required to recover a tile image T which is mapped to the target block B we use the content of the counting table to encode all the residual values computed previously. For each tile image T in mosaic images T', construct a bit stream for recovering which includes:

The index of target image B, The optimal rotation angle of tile image T ($0°, 90°, 180°, 270°$), the mean of tile image T and target image B and the related standard deviation quotients of all three color channels (R, G, and B), The sequence for overflow / underflow residuals.

3

These information is used to recover a tile image T and is integrated in a bit stream M in which bit segments represent the value of the index of target block B, the rotation angle of T, the mean and standard deviation quotients and the residuals of tile image and target image block. The total number bits required for representing all residuals depends on overflow/underflow in T' concatenate the bit stream M_i of all tile images to form a total bit stream M_t in order to protect M_t from being attacked, a secret key K is used to encrypt the bit stream M_t' which is embedded into the pixel pairs in the mosaic image. This process has to be repeated in encoding process since the length of M_t' may be larger than the pixel pairs available in iteration. Here we have to embed some information about mosaic image for recovery process, we construct a bit stream I which includes:

The number of iterations in process for embedding the bit stream $M_t^{'}$, the number of pixel pairs used in last iteration$M_t^{'}$, The Huffman table for residuals and embed the bit stream I into mosaic image.

Finally getting a mosaic image and insert into the all target frames. Merging all the frames and building video in "avi" format for images

Part II: Secret Image Recover from Video

Here the user has uploaded a video contains a mosaic image and at receiver end, so the user at receiver end has to extract all the frames from the video files and has to recovery all secret images tiles T from the mosaic image. The first step here is to extract the bit stream I by reverse version and decode it to obtain the embedded information for mosaic image for recovery process which contains the information related to the number of iteration in process for embedding the bit stream $M_t^{'}$ the number of pixel pairs used in last iteration and Huffman table for residuals for overflow and underflow.

The second step is to extract the bit stream $M_t^{'}$by the reverse version and decode it to obtain M_i bit stream by secret key K which contain the embedded information related to recovery of tile image T in mosaic image T'. Decode M_i for each tile image to obtain the following data: 1).The index of block in corresponding of T' 2).The optimal rotation angle θ of tile image ($0°, 90°, 180°, 270°$) 4). The mean of tile image and block and related standard deviation quotients of all (R, G, and B) color channel 4). The overflow and underflow sequence residual.

The third step is to recovering the secret image, for this raster scan is done on tile image T of the desired secret image by the following steps

1. Rotate in the reverse direction the block index B in the bit stream M through the optimal angle $\theta^o$and fit the resultant into T as an initial tile image

2. By using mean and standard deviation quotients to recover the original pixel value in tile image T.

Scan T to find out pixel values with 0 to 255 which indicates overflow and underflow which occurred.

3. Add the respective values from counting table for the record, each having index corresponding to residual data value, and assign an initial value for each entry to find the pixel.

4. Know by taking all the result as final pixel value in final tile image T, compose to form the desired secrete image as output.

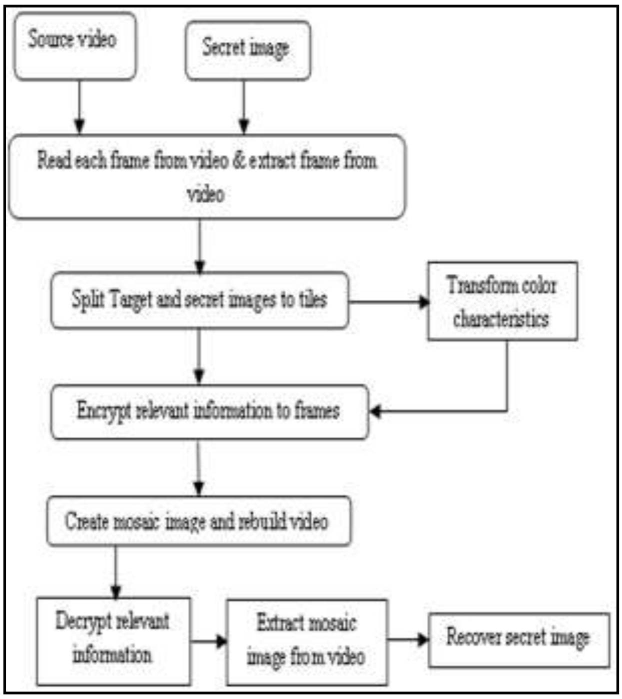

Figure -1: Block diagram for proposed method

3.2 Proposed Algorithms for Method

The algorithm in the proposed method is divided as

Algorithm: 1 for Mosaic video creation

Algorithm: 2 for Secret image recover from video

Algorithm 1 Mosaic image creation (Video):

1. Input: a secret image S, a target image (video) T, and a secret key K.
2. Output: a secret-fragment-visible mosaic image F.

Part 1: Fitting the tile images into the target blocks

Step.1. If the size of the target image *T* is different from that of the secret image *S*, change the size of *T* to be identical to that of *S*; and divide the secret image *S* into *n* tile images (T1, T2, . . , Tn)as well as the target image *T* into *n* target blocks (*B*1, *B*2,..,*Bn)*with each *Ti* or *Bi* being of size N_T.

Step.2. Compute the means and the standard deviations of each tile image $T_i$and each target block $B_j$for the three color channels according to (1) and (2); and compute accordingly the average standard deviations for T_i and B_j, respectively, for *i* = 1 through *n* and *j* = 1 through *n*.

Step.3. The tile images are to be sorted in the two : first on set *Stile* = {T1, T2, . . . , Tn}and second : the target blocks in the set called S_{target}= {B1, B2, . . . , Bn}according to the computed average standard deviation values of the blocks for both sets ; know mapping is done in accordance to order the blocks in the sorted S_{tile} to that in the sorted *Starget* set-in a manner 1 to 1; and reorder the mappings according to the tile images, resulting in a mapping sequence *L* of the form: $T_1 \rightarrow B_{j1}$, $T_2 \rightarrow B_{j2}$, . . . , $T_n \rightarrow B_{jn}$.

Step.4.know Create a mosaic image F by fitting the tile images into the corresponding target blocks according to L.

Part.2. Color conversions between the tile images and the target blocks (video frames)

Step.5. Create a table TB with 256 entries, for color conversion each with an index corresponding to a residual value, and Asian an initial value of zero to each entry of the table (here note down that each residual value should be in the range of 0 to 255).

Step.6. For each mapping $T_i \rightarrow B_{ji}$ in sequence *L*, represent the means μ_c and μ'_c of T_i and B_{ji} respectively, by 8 bits; and represent the standard deviation quotient q_c appearing in equation (4) by 7 bits, according to the scheme described ,where *c* = *r*, *g*, or *b*. color channel.

Step.7. For each pixel P_i in each tile image T_i of mosaic image *F* with color value C_i where color channel *c* = *r*, *g*, or *b*, transform C_i into a new value C'_i by (4); if C'_i is not smaller than 255 or if it is not larger than 0, then change C'_i to be 255 or 0, respectively; compute a residual value R_i for pixel P_i and increment by 1 the count in the entry in the counting table TB whose index is identical to R_i.

Part.3. Rotating the tile images to be fit in mosaic image

Step.8. Here we have to compute the RMSE values of each color transformed tile image T_i in F for rotating with respect to its corresponding target block B_{ji} after rotating T_i into each of the directions available θ = $(0°, 90°, 180°, 270°)$; and rotate T_i into the optimal direction θ with the smallest RMSE value

Part.4.Embedding the secret image recovery information

Step.9. Construct a Huffman table HT using the content of the counting table TB to encode all the residual values computed previously.

Step.10. For each tile image T_i in mosaic image F, construct a bit stream M_i for recovering T_i, including the bit-segments which encode the data items of: 1) the index of the corresponding target block B_{ji} 2) the optimal rotation angle $\theta°$ of T_i 4) the means of *Ti* and B_{ji} and the related standard deviation quotients of all three color channels C = R, G and B and 4) the bit sequence for overflows/underflows with residuals in *Ti* encoded by the Huffman table HT.

Step.11. Concatenate the bit streams M_i of all tile images T_i in mosaic image *F* in a raster-scan order to form a total bit stream M_t; use the secret key K to encrypt M_t into another bit stream M'_t; and embed M'_t into F by the reversible contrast mapping.

Step.12. Construct a bit stream I including: 1) the number of conducted iterations N_i for embedding M'_t; 2) the number of pixel pairs N_{pair} used in the last iteration; and 4) the Huffman table HT constructed for the residuals; and embed the bit stream I into mosaic image F.

Algorithm 2: For Secret image recover from video frames

Part.1: Extracting the secret image recovery information (mosaic image)

Step.1. Extract from F mosaic image (video)the bit stream I by a reverse version and obtain the following data items: 1) the number of iterations for embedding ; 2) the total number of pixel pairs N_p used in the last iteration; and 4) the Huffman table HT for encoding the values of the residuals of the overflows or underflows

Step.2. Extract the bit stream M'_t using the values of N_i and N_{pair}

Step.3. Decrypt the bit stream M'_t into M_t by K

Step.4. Decompose M_t into n bit streams M_1 through M_n for the n to-be-constructed tile images T_1 through T_n in *S*, respectively.

Step.5. Decode $\mathrm{M_i}$ for each tile image $\mathrm{T_i}$ to obtain the following data items: 1) the index $\mathrm{j_i}$ of the block $\mathrm{B_{ji}}$ in F corresponding to $\mathrm{T_i}$; 2) the optimal rotation angle $\theta°$ of $\mathrm{T_i}$ 3) the means of $\mathrm{T_i}$ and $\mathrm{B_{ji}}$ and the related standard deviation quotients of all color channels C = R, G and B; and 4) the overflow/underflow residual values in $\mathrm{T_i}$ decoded by the Huffman table HT.

Part. 2. Recovering the secret image from video

Step.6. Recover one by one in a raster-scan order the tile images $\mathrm{T_i}$, i= 1 through n, of the desired secret image S: 1) rotate in the reverse direction the block indexed by $\mathrm{j_i}$, namely $\mathrm{B_{ji}}$, in F mosaic image through the optimal angle $\theta°$ and fit the resulting block content into $\mathrm{T_i}$ to form an initial tile image $\mathrm{T_i}$; 2) use the extracted means and related standard deviation quotients to recover the original pixel values in $\mathrm{T_i}$ according to equation (4); 4) use the extracted means, standard deviation quotients, and equation (5) here we have to compute the two parameters smallest color value c_s and largest color value c_L; 4) know scan $\mathrm{T_i}$, to find out pixels with values 255 or 0 from the table which indicate that overflows or underflows, for the pixel respectively, have occurred there; 5) add respectively the values smallest and largest for color c_s or c_L to the corresponding residual values of the found pixels after computing; and 6) take the results as the final pixel values, resulting in a final tile image $\mathrm{T_i}$.

Step.7.Compute and compose all the final tile images after performing operation to obtain the desired secret image S as output.

4. SIMULATION PROCESS

The proposed method in this dissertation report is related to video, in this section the detail process is explained below.

Create the .m file in MATLAB which contain the code for creating the mosaic image (video); the code defines the methodology for result i.e., how to perform the operations. Let the file be video.m file which contain the code. Select the Target video T with extension *.avi and Secrete Image S, here the important thing which is to be done is to select the size 1028x768 i.e., T should be identical to S; if the image is not identical we have resize it. As from the algorithm 1 whole process is explained for creating the mosaic image. Here we have select the FF 1:20 the value can be varied accordingly.

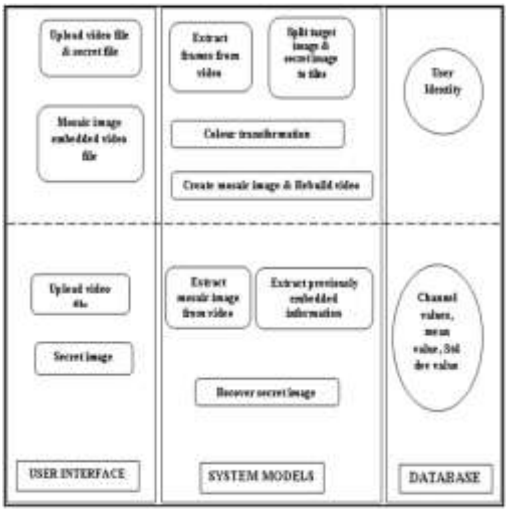

Figure -2: Block diagram for the modified process

1. Create a folder on your desktop called Mosaic video

2. Save one video with *.avi as target video and secrete image (Target Image (video) T and secrete image S) and the Video.m file into the folder you just created.

3. Open Mat lab program on the personal computer you are working on.

4. Open the Video.m file

5. Change the script so that it uses the images you want to mosaic. In experiment they are called target video and secrete.jpg. Save the changes and close the window

6. Run Video.m file an new window open, select an input image (Target video) saved in image folder, a new window open again and select secret image

7. On main window two different figures will open in two windows first Target video Figure 2 secret image.

8. Figure 3 i.e. video will be the mosaic video

The main AVI fie is nothing but a sequence of image called frames. Initially we will like to stream the video and collect all the frames and also collect the information if the video sequence is large enough, the frame period can be accordingly large. The encoder reads these parameters from a file

The above mentioned steps explain in brief the mosaic video creation techniques and the steps involved in creation.

This method is divided into two phases a) mosaic image creation b) recovery, the first phase is sub divided into the following parts & the details has been explained in previous chapter

1. Color transformation between blocks

2. Choosing appropriate target blocks and rotating blocks

3. Embedding information for secret image recovery.

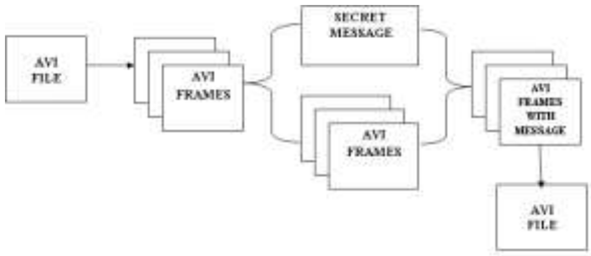

Figure -3: AVI Video Streaming

As experiment has been conducted to test the proposed method here we have taken input as video *.avi as target or source file and secret image as S and video frame rate 1:20 which can be varied accordingly.

Figure -4: Result yielded by proposed method 1.Source file (Target image) 2 Secret image 3 Mosaic video 4 extracted secret image

5. RESULTS & CONCLUSIONS

Parameters	Steganography	Watermarking	Cryptography	Mosaicing
Input	Two files	One file	One	Two files
Techniques	LSB, Spatial Domain	Transposition, RSA	DCT	LSB, RCM
Objective	Secret communication	Copyright protection of data	Data protection	Data protection and transmission
Key	Optional	Optional	Yes	Yes
Capacity	Low hiding capacity	Depends upon hiding Data	High capacity	Very high capacity

5. Conclusion

A new method for data hiding and securely image transmission through videos has been proposed and verified in this dissertation, which can not only create meaningful mosaic image but can also transform a secret image into a meaning full mosaic video to cover a secrete data for transmission, used as camouflage of secret image. The proposed system does not require any database; the user can select any video of his wish as the target (source) video. The color transformation and the skillful schemes for handling the characteristics condition are done in the conversion values of pixel, and visible mosaic images with close similarities. Moreover there is lossless recovery of the original secret image from the created mosaic video.

The experimental result has shown the great feasibility of the proposed method.

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