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A Survey On Image Matching Methods

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ABSTRACT : Image matching is the process of bringing two images geometrically into agreement so that matching pixels in the two images matches to the same physical region of the area being imaged. Matching algorithms plays a key role in deciding correspondences between two image scenes. The matching algorithms are of two types area based matching and feature based matching. This paper aims to present a review of various image matching methods.

KEYWORDS –DEM,FSIFT, Image matching, Phase Correlation, SIFT, SURF.

I. INTRODUCTION

Image matching can be applied to number of applications that require the functionality of identifying and searching of matching images. The main key issues of various image based applications, such as change detection for map updating and automated navigation based on optical vision. A major challenge for matching images taken in different times is the illumination variation that may cause decorrelation between the images. This illumination invariant of the images can be resolved using the PC (Phase correlation) algorithm.

The survey consist of the different methods and algorithms to image matching, correlation, and feature detection and illumination invariance of two images. After the survey I have summarized the methods and algorithms taken for the survey also includes the merits and demerits. The rest of the paper is organized as follows. In section II the Literature review is described. Concluding remarks of the survey are given in section III.

II. LITERATURE REVIEW

The papers described below are taken for the study of the survey conducted. The each papers describes different methods and techniques which are explained as follows:

David. G. Lowe [1] presents a reliable matching method of extracting distinctive invariant features between images having different views of object or place. The features are invariant to image rotation and scale, distortion, 3D change viewpoint, addition of noise, and illumination change. The features are highly distinctive, which means a single feature of the images can be matched correctly with high probability of large database of features of many images. The paper also describes the features for object recognition. The recognition is done by matching individual features to a database of features from known objects.

M. Aly [2] describes a new algorithm called SIFT (Scale Invariant Feature Transform). Using SIFT the reliable matching features between images are extracted to different views of the same object. The extracted features from images are highly distinctive and are invariant to scale and orientation of the image. The feature extraction is done in four steps. In the first step the locations of potential interest points in the image are computed by detecting the maxima and minima of Difference of Gaussian (DoG) filters which is applied all over the image at different scales. Then, by discarding the points having low contrast the detected locations of points are refined. Then based on local image features an orientation is assigned to each key point. Finally, at each key point a local feature descriptor is computed. This descriptor is transformed to the orientation of the key point based on the local image gradient to provide orientation invariance.

The experiment of SIFT is done in the face recognition. The SIFT features are derived from all the faces in the database. Then, a new face image is taken and the features extracted from the new face are compared with the each face features in the database. The matching features of face in the database in large number is considered as the nearest face, and is used for the new face of classification. The advantage of the SIFT algorithm is that it proves that it is superior to Eigenfaces and Fisherfaces algorithms which are the earliest feature detection algorithms.

J. Krizaj et al. [3] introduced a new method called FSIFT (Fixed-Keypoint SIFT) to overcome the inaccuracy of SIFT. The procedure of FSIFT method is obtained by computing the SIFT method at fixed predefined image locations described during the training stage. Fixing the keypoints to predefined spatial locations will help to eliminate the threshold optimization and face image partitioning, when the developed approach gains greater illumination invariance than other SIFT adaptations. The experiment is done on the Extended Yale B (EYB) face database.

D. R. Kisku et al. [4] described a new Graph Matching Technique on SIFT for face identification system based on features extracted from face images. The paper investigates the performance of identification techniques based on Graph matching topology in SIFT features. This Graph matching topology is invariant to rotation, scale and translation. Face projections on images which is represented by a graph, can be matched into new images by maximizing a similarity function by considering the similarities of the local features and the spatial distortions. To discover the best features between query face SIFT features and database of two graph based on matching techniques that are developed. This technique is used to deal the false pair assignment and to reduce the number of features in database. The two matching algorithms are used to find the matching feature points in database and query face images. The advantage of the system is that it increase in the performance of the system based on the SIFT features. The obtained results show the capability of the system to deal for illumination changes and irregular occurring in the database or the query face image. The identification accuracy results in the improved matching techniques can increase the performance of the system even in the same feature representation space.

D. R. Kisku et al.'s [5] defined a robust face recognition technique based on the matching and extraction of the SIFT features of independent face areas. Both global and local matching strategy is proposed. The proposed local matching technique is based on matching individual salient facial SIFT features by considering the facial landmarks such as the eyes and the mouth of the image. To form a single feature all the SIFT features are combined together to obtain the global matching technique. In order to reduce the identification errors, the Dempster-Shafer (DS) decision theory is applied to merge the two matching techniques. The defined algorithms are analyzed with the ORL and the IITK face databases.

The experiments performed on the ORL face database contains 98.93% of accuracy in recognition and in IITK face dataset scored 96.29% of accuracy in recognition in relative performances over the global matching method.

A. Majumdar et al. [6] defines a different ranking of SIFT features that can be used to reduce the number of SIFT features for face recognition. This method checks the number of irrelevant features to be matched in order to reduce the computational complexity and also increases the recognition accuracy. The system show that the reduction is more than 4 times in the number of computations and 1% increase in the recognition accuracy.

B. Herbert et.al [7] describes a new method Speeded Up Robust Features (SURF) - a fast and good performance interest point detection-description method, which perform the current state-of-the art, in both speed and accuracy. SURF descriptor is based on similar properties, with a compressed complexity. The SURF descriptor is processed in two steps. In the first step, fixing of a reproducible orientation are constructed based on information from a circular region of interest points of features. Then in second step, construction of a square region aligned to the selected orientation is done, and extract the SURF descriptor from it. The SURF descriptor is easily extendable for the description of invariant regions.

W. Maddern et.al [8] uses a method of an illumination invariant transform to improve many aspects of visual localization, mapping and scene classification for autonomous road vehicles. The illumination invariant color space stems from modelling the spectral properties of the camera and conjunction in illumination of area, and requires only a single parameter derived from the image sensor specifications. The results for the use of illumination invariant imaging to improve the performance and robustness of vision-based autonomous road vehicles in typical outdoor environments. The proposed illumination invariant transform is not more complex than RGB to greyscale conversion and need a single parameter derived from the image sensor datasheet.

O. Arandjelovic et.al [9] developed a novel gradient edge map representation for frontal face recognition. The illumination conditions considered include the dominant light source placed behind the side of the user and directly above and pointing downwards and upwards. The presence of cast shadows, poorly illuminated regions of the face, and quantum and quantization noise, makes difficult to extract a sufficiently discriminative robust representation. The proposed method is based on image gradient directions near robust edges. The robust edges are extracted using a group of processing steps, each of which search to control further discriminative information or normalized for a special source of extra-personal appearance.

G. L. K. Morgan et.al [10] describes a stereo-matching algorithm, relating to the robust phase correlation method. The algorithm enables to retrieve complete dense surface shape information from images with unconventionally low B/H ratios potentially allowing DEM generation from images that would not be considered suitable for the purpose. The paper mainly focus on the technical step of subpixel disparity estimation within the depth-from-stereo processing chain. The stereo-matching algorithm is capable of precisely and directly measuring the fractional disparities that result from unconventionally narrow baseline images. The images which would otherwise not be considered suitable for conventional stereo processing. The technical steps for automated stereo image-matching algorithm are: 1) successful identification of corresponding points and 2) accurate measurement of the disparity/shift between the images.

The profit obtained from the subpixel PC method is that it proves to be a robust and accurate image-matching technique which is capable of achieving better accuracy and precision better than 1/50th of a pixel, from both synthetic and real images.

III. CONCLUSION

The survey includes different algorithms and methods to improve the matching of two or more images. The matching can be done by the process of feature and texture extraction based on the requirements we need. The experimental results in the various proposed schemes ensure increased matching features of the images. From the survey I have recognized that various algorithms and methods for enhancing the better quality of matching images.

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