High Quality Depth Map Reconstruction from Sparse Samples using Alternating Direction Method of Multipliers

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Abstract

The rapid progress in 3D technology has enhanced whole the systems to be focused on digital world. Digital analysis mainly include sampling, encoding, decoding the processed data. Depth estimation is one of the interesting phases where we have to adopt new methods that will improve the depth map. Existing methods like hardware and computational procedures leads to high expense as well as deprived depth accuracy. The proposed method highlights how the depth image is reconstructed precisely by adopting proficient computational techniques. This is mainly divided into three sections. First part deals with representation of input depth image which is encoded by using dictionaries. It is preferable to use combination of wavelet contourlet dictionaries rather than single dictionary like wavelet which gives enhanced performance with high peak to signal ratio. Second section propose effective algorithm for reconstruction of depth image named as alternating direction method of multipliers (ADMM). This algorithm is in co-operated with the combined dictionaries and alone in order to fix the best dictionary. In the third section sampling technique with high peak to signal ratio is chosen. Two staged random sampling technique which is improved by principal component analysis (PCA) is being used to pick relevant sampling points for the precise depth reconstruction. Improved depth map with least mean square error is obtained by carefully choosing the dictionary, algorithm and sampling technique.

Keywords: ADMM, PCA, Depth estimation, wavelet contourlet dictionaries, two staged random sampling

I. INTRODUCTION

The proposed method highlights how the depth image is reconstructed precisely by adopting proficient computational techniques. This is mainly divided into three sections. First part deals with representation of input depth image which is encoded by using dictionaries. It is preferable to use combination of wavelet contourlet dictionaries rather than single dictionary like wavelet which gives enhanced performance with high peak to signal ratio. Second section propose effective algorithm for reconstruction of depth image named as alternating direction method of multipliers (ADMM). This algorithm is in co-operated with the combined dictionaries and alone in order to fix the best dictionary. In the third section sampling technique with high peak to signal ratio is chosen. Two staged random sampling technique which is improved by principal component analysis (PCA) is being used to pick relevant sampling points for the precise depth reconstruction. Improved depth map with least mean square error is obtained by carefully choosing the dictionary, algorithm and sampling technique.

II. PROBLEM STATEMENT

There are numerous algorithm like compressive sensing and Markov random filed used for the disparity estimation. Compressive sensing technique comprises of multiple sampling and filtering the unwanted data's. The relevant information's that required for the reconstruction of the depth map is kept aside. The bilateral filter are used for filtering the deprive sample patterns in sensing techniques. This increases the necessity for formulating and designing efficient filter with their pre-defined coefficients, which adds to increase the complexity.

Markov field is not applicable for non-uniform sampling and combined filtering action results in low resolution outputs. Drawbacks in these systems paved the way for fast and efficient alternating direction method of multipliers (ADMM). The proposed algorithm is applicable for any non-uniform samples and does not require color image as the input. Any grey scale input can be fed to see the progress and functioning without any additional filtering stage.

III. PROPOSED METHOD

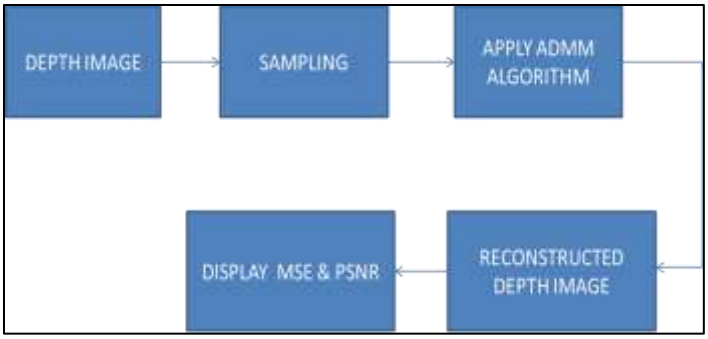

Fig. 1: Block Diagram of proposed method where the depth map is reconstructed

The above block diagram shows how the input depth image is reconstructed by a series of operation. First the image should be input which is stored in appropriate location. Here combined dictionaries wavelet-contourlet is used for better performance and to get precise depth map. After that the input image should be sampled either by using principal component analysis (PCA), oracle random sampling or uniform random sampling with defined sampling rate. After that apply advanced Lagrangian function ADMM for the reconstruction. This is the application of augmented Lagrangian function. The Lagrangian function is again minimized by using ADMM algorithm over three dimensional a, b, c.

IV. PROPOSED ALGORITHM

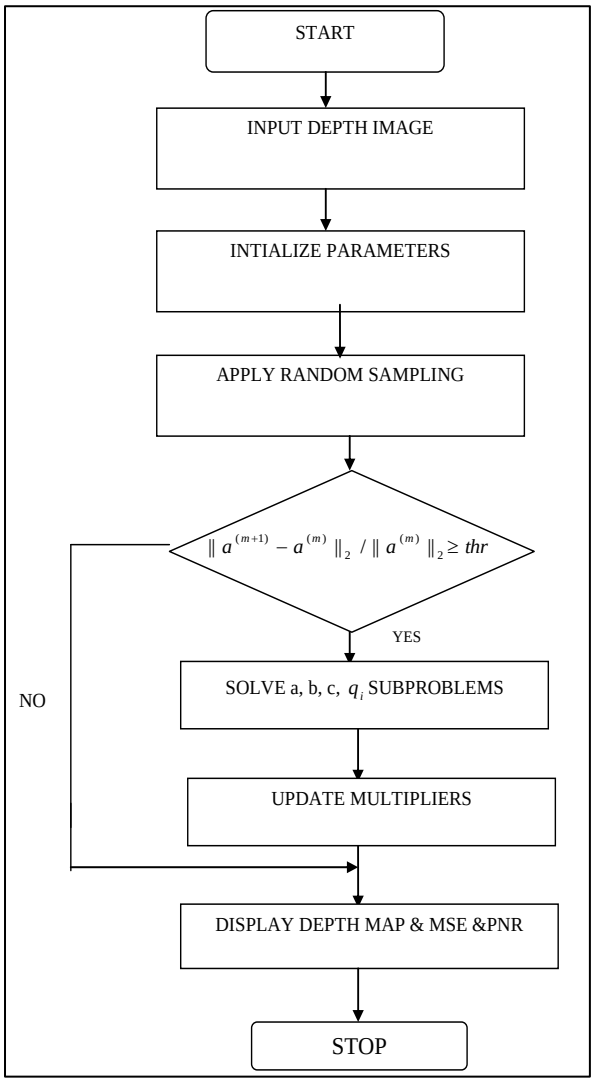

Fig. 2: Flow Chart of ADMM

V. RESULTS

Table – 1
Comparison of simulated results

ADMM WITH	*PSNR*	*MSE*
SINGLE WAVELET	*27.072*	*0.001632*
WAVELET CONTOURLET	*28.520*	*0.001705*
TWO STAGE RANDOM SAMPLING	*31.70*	*0.000675*
TWO STAGE WITH PCA	*35.93*	*0.000255*

Fig. 3: Reconstructed using two stage improved by PCA

Fig. 4: Reconstructed using combined dictionaries

VI. CONCLUSION

This project reflects an effective method for reconstructing the depth image. The project has concluded with criteria's which will enhance the reconstruction process. In the first section the input has successfully encoded with combined dictionary which has resultant in high peak to signal ratio. Second finding was based on proposed algorithm and findings how comes it is compactable with resultant of the first section. This has been analyzed for various iterations and concluded that ADMM has fastest convergence that of conjugate methods. From the simulation results it has proven that two stage random sampling with PCA will assure high quality output.

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