DISTANCE MEASUREMENT BY SINGLE LENS IMAGE

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ABSTRACT

THERE ARE TWO DISTINCTLY DIFFERENT WAYS TO MEASURE THE DISTANCE OF OBJECT BY USING OPTICAL CAMERA: METHODS OF DUAL LENSES FOCUSING（STEREO VISION） AND SINGLE LENS DEFOCUSING. HOWEVER, BECAUSE THERE IS A PROBLEM OF THE OBJECTS CORRESPONDENCE BETWEEN THE IMAGES TAKEN BY DIFFERENT LENS, THE DISTANCE MEASURED WITH THE METHOD OF DUAL-LENSES CAMERA IS USUALLY NOT RELIABLE. THEREFORE, THERE HAVE BEEN MORE AND MORE RESEARCH ACTIVITIES AND THEORIES OF MEASURING DISTANCE TECHNIQUE BY METHOD OF SINGLE OPTICAL LENS BASED ON PRINCIPLE OF DEPTH-FROM-DEFOCUS. THE PRINCIPLE OF THE DEPTH-FROM-DEFOCUS IS USING THE BLURRING SITUATION OF IMAGE TAKEN FROM LENS' INACCURATE FOCUSING ON ESTIMATING THE DISTANCE OF THE OBJECT FROM THE CAMERA, AND THEN THE EXACTLY SAME SCENE WERE TAKEN SEVERAL TIMES WITH FOCUSED OR DEFOCUSED IMAGES BY CHANGING LENS PARAMETERS TO FURTHER CALCULATE THE BLURRING GRADIENT OF THE SAME BLOCK AREA FROM DIFFERENT IMAGES DATABASE. FROM THE CALCULATION OF BLURRING GRADIENT, WE CAN DERIVE THE NEAR/FAR DISTANCES OF THE OBJECTS IN DIFFERENT BLOCK AREAS OF THE COMPLETE IMAGE. BECAUSE OF NOISE INTERFERENCE OF THE IMAGE SENSOR AND SPATIAL SHIFT DEVIATION ERROR DUE TO LENS SHIFTING BETWEEN MULTIPLE IMAGING ACTIVITIES FROM ONE TO ANOTHER, THE ACCURACY OF THE DISTANCE MEASURED IS USUALLY AFFECTED. THE PREVIOUSLY PUBLISHED RESEARCH RESULTS WERE ALMOST LIMITED IN THE IDEALLY EXPERIMENTAL ENVIRONMENT WITHOUT CONSIDERATION OF PROBLEMS IN PRACTICAL APPLICATION, THUS THEY WERE LACK OF PRACTICALLY IMPLEMENTATION VALUES. THIS THESIS APPLIES THE METHODS OF LEAST-SQUARE ERRORS TO AVOID THE PROBLEMS MENTIONED AND FURTHER TO IMPROVE THE ACCURACY. WE FIRST PROVIDE THE REQUIRE MATHEMATICAL FORMULATIONS, AND THEN VERIFY THE NOVEL TECHNIQUE WITH SIMULATION RESULTS. FINALLY, WE PROVIDE ASSESSMENT ABOUT THE EFFICIENT SOLUTION TO THIS METHOD AND ALSO PROPOSE SEVERAL OPTIMAL CONFIGURATIONS TO IMPLEMENT THIS TECHNIQUE IN PRACTICAL APPLICATIONS. THE RESULTS OF THIS RESEARCH WILL GREATLY HELP SOLVE THE TROUBLE MET BY THE METHODS OF DISTANCE MEASURING FROM DEFOCUS IN SINGLE LENS IMAGES, AND IT WILL CONTRIBUTE IN THE RESEARCH AREA OF COMPUTER VISION.

Keywords : KEY WORDS, KEY WORDS, KEY WORDS, KEY WORDS, KEY WORDS

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