

3D Human Face Reconstruction in Unstable Conditions

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Abstract : 3D object reconstruction is a broad research area within the computer vision field involving many stages and still open problems. One of the existing challenges in this field lies with micromotion, such as the facial expressions on the appearance of the human or animal face. Similar literatures in this field focuses on 3D reconstruction in stable conditions such as an existing image or photos taken in a rather static environment, while the purpose of this work is to discuss a flexible scan system using multiple cameras that can correctly reconstruct 3D stable and moving objects -- human face with expression in particular. Further, a mathematical model is proposed at the end of this literature to automate the 3D object reconstruction process. The reconstruction process takes several stages. Firstly, a set of simple 2D lines would be projected onto the object and hence a set of uneven curvy lines can be obtained, which represents the 3D numerical data of the surface. The lines and their shapes will help to identify object's 3D construction in pixels. With the two-recorded angles and their distance from the camera, a simple mathematical calculation would give the resulting coordinate of each projected line in an absolute 3D space. This proposed research will benefit many practical areas, including but not limited to biometric identification, authentications, cybersecurity, preservation of cultural heritage, drama acting especially those with rapid and complex facial gestures, and many others. Specifically, this will (I) provide a brief survey of comparable techniques existing in this field. (II) discuss a set of specialized methodologies or algorithms for effective reconstruction of 3D objects. (III)implement, and testing the developed methodologies. (IV) verify findings with data collected from experiments. (V) conclude with lessons learned and final thoughts.

Keywords : 3D photogrammetry, 3D object reconstruction, facial expression recognition, facial recognition

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