3D Keypoint detection with Deep Neural Networks

Elías J. Puma

Escuela Profesional de Ciencia de la Computación,
Universidad Nacional de San Agustín,
Arequipa, PE
Email: eliasj.puma@gmail.com

3D keypoint detection plays a fundamental role in the Computer Vision field, detection of these salient points in the local surfaces of a 3D object is important in order to perform certain tasks such as registration, retrieval and simplification. There has been a lot of research in the field of 3D keypoint detection, most of them take a geometrical approach which have a good performance but lack flexibility to adapt to changes such as noise and high curvature points that are not keypoints to human preference. A good approach seems to be machine learning methods that can be trained with human annotated training data. In this paper a new method is proposed using deep neural network with sparse autoencoder as the regression model due to their great ability for feature processing. The analysis shows this method outperforms other methods that are widely used.

Keywords: Keypoint detection; Deep Neural Networks; 3D Model; Sparse Autoencoders

1. INTRODUCTION

Several computer-dependent areas are benefited of the applications that 3D Models have in them. The growth of 3D data has increased in the last years with the availability of low-cost 3D capture devices [1]. The ability to analyse, proccess and select relevant information from them is an active research area.

3D interest point detection is a difficult task for several reasons [3, 1]. First, there are not any definitions for what a interest point is, most of the approaches consider the high level of protusion in a local area as a keypoint characteristic. So, in planar sections of an area vertices have a low interest level and in local areas with diferent structures the interest level will be the opposite. Second, vertex density is different for every 3D model which makes harder the task of selecting a local area. Third, information obtained from a 3D model are only vertex positions and connectivity between them which means the interest level will depend only from the information we can retrieve from different calculations. These are not the only reasons but are sufficient for explaining why this method is prepared to handle these difficulties.

The common approach to 3D keypoint detection has been to use geometric properties of the models, although in recent years researchers also have developed machine learning techniques that try to outperform the former one by avoiding the problems of: Different tasks in different areas of the model [2], false positives obtained from noise or local variation and keypoint detection valuable according to human preference.

2. CONCLUSIONS

ACKNOWLEDGEMENTS

This research was undertaken as part of ...

REFERENCES

[1] I. Sipiran, B. Bustos (2011) Harris 3D: a robust extension of the Harris operator for interest point detection on 3D meshes Santiago, Chile: Springer, 2011.

[2] X. Lin, C. Zhu, Q. Zhang y Y. Liu (2016) 3D Keypoint Detection Based on Deep Neural Network with Sparse Autoencoder Chengdu, China: UESTC.

[3] L. Teran, P. Mordohai (2013) 3D Interest Point Detection via Discriminative Learning Stevens Institute of Technology, EUA, 2013.