CS 292F.300 Final project proposal

Noah Stier

TOTAL POINTS

1 / 1

QUESTION 1

1 Proposal submitted 1 / 1

✓ **- 0 pts** **Correct**

This sounds great. I look forward to reading it.

CS 292F Project Proposal:
Literature review on graph laplacians in 3D scene understanding
Noah Stier

I have chosen two papers that apply the graph Laplacian and that are related to my main research interests: 3D scene sensing, recognition, and reconstruction. In these areas, I see two main threads of research that utilize the graph Laplacian:

1. regularization, smoothing, and filtering of point clouds and mesh surfaces;
2. convolutional neural networks on graphs (GCNNs).

The most compelling uses of GCNNs have been in recognition tasks (such as segmentation and classification of meshes and point clouds), whereas the regularization and smoothing techniques have been more heavily applied in reconstruction. The two are interrelated and can both be considered forms of scene understanding.

The first paper I will cover is a seminal work in mesh smoothing: "A signal processing approach to fair surface design" (Taubin, 1995). It lays the theoretical groundwork and is still often cited in computer graphics and vision.

The second paper is foundational to the field of GCNNs: "Deep convolutional networks on graph-structured data" (LeCun, 2015). These GCNNs have in turn led to advances in machine learning on point clouds and meshes, enabling, for example, accurate segmentation and classification on these data structures.

I also plan to choose one additional paper which applies GCNNs to point cloud or mesh segmentation, and one additional paper which applies graph Laplacian regularization to point cloud denoising. There are many options for each of these. Two examples are “3d point cloud denoising using graph laplacian regularization of a low dimensional manifold model" (Yang, 2019), and "Dgcnn: A convolutional neural network over large-scale labeled graphs" (Bui, 2018).

By choosing to cover two topics I limit the depth of my survey in favor of breadth, because I would like to be conversant in both areas. I think it will be feasible but I am also open to narrowing the scope

References

Henaff, Mikael, Joan Bruna, and Yann LeCun. "Deep convolutional networks on graph-structured data." arXiv preprint arXiv:1506.05163 (2015). https://arxiv.org/pdf/1506.05163.pdf

Taubin, Gabriel. "A signal processing approach to fair surface design." In Proceedings of the 22nd annual conference on Computer graphics and interactive techniques, pp. 351-358. 1995. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9007740&casa_token=f_VkAG2BHL0AAAAA:m_SEFX8hl_ewaf4jLLLXQbueQg_TKDugU85RHwxY8ZscFBZjB1h5QSiNeqAQTKoRQamrD5E

Zeng, Jin, Gene Cheung, Michael Ng, Jiahao Pang, and Cheng Yang. "3d point cloud denoising using graph laplacian regularization of a low dimensional manifold model." IEEE Transactions on Image Processing 29 (2019): 3474-3489. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=8945167&casa_token=ARx3wLnFx9AAAAAA:gLd4I-XquCUiSh9BWxCPLNP0LsmzrhgS3U8pBF7e8IVB8VMBL1FXfVn-8EKtYdHEM5WzeSU

Phan, Anh Viet, Minh Le Nguyen, Yen Lam Hoang Nguyen, and Lam Thu Bui. "Dgcnn: A convolutional neural network over large-scale labeled graphs." *Neural Networks* 108 (2018): 533-543. https://www.researchgate.net/profile/Anh-Phan-9/publication/327819178_DGCNN_A_convolutional_neural_network_over_large-scale_labeled_graphs/links/5c3b4bd192851c22a3721a72/DGCNN-A-convolutional-neural-network-over-large-scale-labeled-graphs.pdf

1 Proposal submitted 1 / 1

✓ **- 0 pts Correct**

This sounds great. I look forward to reading it.