CSC 2523 Modeling and Object Recognition Project Proposal

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Project Title:
Multilevel Object Closure Detection By Superpixels

Motivation:
The closure of any object in an image sets the scope for the pixels for the object, and those pixels in the closure can be used for further application, for example neural network models for recognition tasks. Finding a good closure for an object thus can be thought as a preprocessing to focus the recognition on a specific object instead of finding a main object among a few possible objects. In fact, in any image, the definition of objects can be vague and abstract. However, if we treat objects in different level, then we will be able to have priority in detecting objects in an image. For example, an image may contain a car, a tree, and a person. This might be the most outer level of objects. Then, in the car, there are the front windshield, wheels, front hood, headlights, and so on. These are the objects in the next level constrained by the closure of the car, and they can also be detected by their closures. Therefore, depending on the need of the user, for instance how specific for objects and in what range, the project can use superpixels to both set a scope for object-searching and find the closures for the possible objects in that scope. In other words, the project will consider that objects are contained in the object of the upper level, like the relationship between a car's components and the car. If we can extract objects in different levels by their closures, the further recognition applications will be more efficient.

Goal:
Apply superpixels to detect objects' closures in different levels, so that the results can be used for more specific further usage.

Resources Needed:
- Papers of different applications of superpixels.
- Existing code for implementing the superpixels and finding the basic closures for an image.
- Images that have been tagged for multiple objects within each of the images.

Related Readings (unsorted):
[1] The representation and matching of categorical shape, 2006, by Ali Shokoufandeh, Lars Bretzner, Diego Macrini, M. Fatih Demirci,Clas JoÅNnsson, Sven Dickinson.

[2] View-based object recognition using saliency maps, 1998, by Ali Shokoufandeh, Ivan Marsic, Sven J. Dickinson.

[3] Closing the Loop for Edge Detection and Object Proposals, 2017, by Yao Lu and Linda Shapiro.

[4] Efficient Closed Contour Extraction from Range Image's Edge Points, 2005, by Angel D. Sappa.

[5] Segmentation of Multiple Salient Closed Contours from Real Images, 2003, by Shyjan Mahamud, Lance R. Williams, Karvel K. Thornber, and Kanglin Xu.

[6] SLIC Superpixels, 2010, by Radhakrishna Achanta, Appu Shaji, Kevin Smith, Aurelien Lucchi, Pascal Fua, and Sabine Susstrunk.

[7] Superpixel Hierarchy, 2016, by Xing Wei, Qingxiong Yang, Yihong Gong, Ming-Hsuan Yang, Narendra Ahuja.

[8] Superpixel Benchmark and Comparison, by Peer Neubert and Peter Protzel.

[9] Superpixel Segmentation using Linear Spectral Clustering, 2015, by Zhengqin Li, Jiansheng Chen.