

PhD proposal : Robust line drawing of unstructured 3D meshes

Topic : Computer Graphics

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In the field of CAD design and technical documentation, line drawing is applied to convey efficiently object salient features. Computer graphics has for many years proposed extraction and rendering methods of lines from 3D object. Nevertheless, none of the current methods are robust to unstructured polygon meshes commonly found in the production pipeline. These meshes lacks 3D connectivity and are likely to contain numerical error or data duplication.

The goal of this work is to propose robust extraction of salient lines from any kind of 3D data. Three extraction approaches may be considered : image-based [1], mesh-based [2] and hybrid between image- and mesh-based. Image based extraction do not use the 3D knowledge of the underlying mesh, and thus ignores data incorrectness, as soon as a good G-Buffer can be rendered from geometry. While image based approaches seems robust, they misses essential shape information from 3D data. In the case of unstructured 3D meshes, 3D line extraction aim at reconstructing the missing information. By taking an hybrid approach, the idea is to not reconstruct all the information but focus on part of the 3D meshes where a line is expected. A key point of this work is also clarity of representation: line drawing must allow level of details to represent 3D data at different scales.

A great attention will also be devoted to evaluation. Results of the developed methods would be evaluated by end user and ideally would be integrated in production pipeline to automate tedious human drawing process.

The ideal candidate will have a master degree in computer science, with a specialization in computer graphics or geometry processing. A basic knowledge of C++, OpenGL, GPU programming (e.g. glsl shader or CUDA) is a plus.

Key-words: computer graphics, geometry processing, mesh processing, line-based rendering, line drawing, computer aided design, feature lines extraction.

References

- [1] Romain Vergne, David Vanderhaeghe, Jiazhou Chen, Pascal Barla, Xavier Granier, and Christophe Schlick. Implicit brushes for stylized line-based rendering. *Computer Graphics Forum*, 30(2):513–522, 2011.
- [2] Shin Yoshizawa, Alexander Belyaev, and Hans-Peter Seidel. Fast and robust detection of crest lines on meshes. In *ACM Symposium on Solid and Physical Modeling*. ACM, 2005.

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