GSCOP 2019 thesis topic

Title : Immersive and Interactive Visualisation of Design Knowledge Graphs in a Computer Aided Design Environment.

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PhD School : ED I-MEP2

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Proposed funding - Context - Potential partners : La demande d'une allocation de recherche de l'école doctorale I-MEP2 est en cours.

Brief Description: To avoid design errors, companies collect massive sets of design rules. Although recent research studies have proposed to replace unusable documents with graph-oriented knowledge structures (e.g. ontologies, graph databases, etc.), the size of the knowledge graph remains too large to be efficiently used. The Ph.D thesis therefore aims at inventing new interactive virtual and augmented reality scenes for visualizing design rules stored in a high dimensional knowledge graph. The new interactive visuals shall enable a designer to easily retrieve, learn, and satisfy design rules and consequently provide proof designs. In addition to facilitate the exploration of design rules, the virtual environment shall provide new visual metaphors that ease the fusion of the multiple design rule representations (text, 2D image, table, chart, etc.) and the models (3D kinematics, 3D geometric DMU, 0D multi-physics, etc.) within which the rules are implemented. Augmented reality technology could finally serve as a means for continuous learning if the application enables a designer to observe a physical product enriched with design rules annotations queried from the knowledge graph.

Bibliographie

[1] R. Pinquié, P. Véron, F. Segonds, and T. Zynda, "A Property Graph Data Model for a Context-Aware Design Assistant," in *IFIP 16th International Conference on Product Lifecycle Management*, 2019.

[2] Laurens van der Maaten and G. Hinton, "Visualizing Data using t-SNE Laurens," *J. Mach. Learn. Res.*, vol. 9, pp. 2579–2605, 2008.

[3] D. Archambault, T. Munzner, and D. Auber, "Tugging graphs faster: Efficiently modifying path-preserving hierarchies for browsing paths," *IEEE Trans. Vis. Comput. Graph.*, vol. 17, no. 3, pp. 276–289, 2011.

[4] C. Vehlow, T. Reinhardt, and D. Weiskopf, "Visualizing fuzzy overlapping communities

in networks," *IEEE Trans. Vis. Comput. Graph.*, vol. 19, no. 12, pp. 2486–2495, 2013.

[5] B. Bach, E. Pietriga, and J. D. Fekete, "Graphdiaries: Animated transitions andtemporal navigation for dynamic networks," *IEEE Trans. Vis. Comput. Graph.*, vol. 20, no. 5, pp. 740–754, 2014.

[6] M. Figueiredo, P. J. S. Cardoso, J. M. F. Rodrigues, and R. Alves, "Learning Technical Drawing with Augmented Reality and Holograms," *Recent Adv. Educ. Technol. Methodol.*, pp. 1–20, 2017.

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