

3D Wind Visualization

Context:

Urban climate data visualization can be useful to understand relationships between climate and city morphology [1], for example the influence of buildings on the wind [4], or the temperature spatial distribution through co-visualizations [1].

Multiple techniques exist to visualize 2D flow direction and speed [2,5,6]. These techniques are currently used in wind 2D visualizations such as <https://www.windy.com> and <https://earth.nullschool.net/fr/>. Some of these techniques have been extended for 3D visualization [3], such as animated textures [3] or glyph-based visualizations [4] and are efficient to understand flow's global structure. 3D urban wind visualization requires visualizing the wind flow and city objects, such as buildings, at the same time. However, the use of 3D flow visualization techniques remains under explored for these use cases.



Fig 1: Wind visualization using a combination of 2D flow visualization techniques [2].

Fig 2: Wind visualization using 3D glyphs through Augmented Reality [4].

Objectives

The goal of this internship is comparing different 3D flow visualization techniques to depict wind in urban environments. To achieve this, the intern will perform the following tasks:

- State of the art of 3D flow visualization techniques
- Implementation of the selected flow visualization techniques using Three.js
- Perceptual comparison of the techniques, considering different co-visualization scenarios, and environments (immersive or non immersive)
- Proposition of new techniques, or combination of existing techniques that might be better than the existing ones



Profile

Student in masters on Computer Graphics, Information Visualization, Human Computer Interaction or Geographical Information Sciences

Desirable skills: Javascript, three.js

Duration

5-6 months, starting January 2021

Location

The internship will take place at [IGN](#) - [LaSTIG](#), in the [GEOVIS](#) (73 avenue de Paris 94160 Saint-Mandé, France) team in collaboration with the DEVI team at [ENAC](#).

Contacts

Please send a CV, cover letter and grades transcript to:

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References

- [1] Gautier J., Brédif M., Christophe S., 2020. Co-visualization of air temperature and urban data for visual exploration. IEEE VIS Short Paper Proceedings, published in IEEE Xplore
- [2] Lobo, M.-J., Telea, A. and Hurter, C. (2020), Feature Driven Combination of Animated Vector Field Visualizations. Computer Graphics Forum, 39: 429-441. doi:[10.1111/cgf.13992](https://doi.org/10.1111/cgf.13992)
- [4] Ritterbusch, Sebastian, et al. "Augmented reality visualization of numerical simulations in urban environments." *International Journal of Advances in Systems and Measurements* 6.1 (2013): 26-39.
- [3] Telea, Alexandru, and Jarke J. van Wijk. *3D IBFV: Hardware-accelerated 3D flow visualization*. IEEE, 2003.
- [5] Van Wijk, Jarke J. "Image based flow visualization." *Proceedings of the 29th annual conference on Computer graphics and interactive techniques*. 2002.
- [6] Wegenkittl, Rainer, Eduard Groller, and Werner Purgathofer. "Animating flow fields: rendering of oriented line integral convolution." *Proceedings. Computer Animation'97 (Cat. No. 97TB100120)*. IEEE, 1997.