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Ph.D. Student, under the supervision of Pascale Le Gall
Defense planned for the fall

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Research Topics

The objective of my thesis is the design of assistance mechanisms for the conception of geometric modeling operations. My work lies at the interface between topology-based geometric modeling and algebraic graph transformations within the Jerboa platform (http://xlim-sic.labo.univ-poitiers.fr/jerboa/).

Keywords
DPO graph transformations: Labelled graphs · Concistency preservation · Rule schemes · Functorial generalization · Pullback application · Static analysis
Topology-based geometric modeling: Combinatorial maps · Inference of operations from examples · Procedural modeling · Interactive design · Automatic programming · Mesh models

- [Pascual et al., 2022b]: article published in the special number "Application-oriented aspects of graphs and graph transformation" of the journal "Science of Computer Programming". This article extends the formal framework of Jerboa to provide a categorical approach to the conception of rule schemes (rules extended with an orbit variable). This extension also entails the manipulation of oriented maps, a more commonly used model in topology-based geometric modeling.
- [Pascual et al., 2022a]: article published in the journal "Graphics and Visual Computing", a preliminary version has been presented at the "journées du GTMG 2021". This second paper deals with the inference of topological operations from two instances of an object (before and after modification) by a quotient algorithm.
- [Arnould et al., 2022]: article in minor revision at the journal "Mathematical Structures in Computer Science". This third article extends rule schemes with orbit completion to guarantee the preservation of geometric consistency. The conditions are defined and studied in a set-based fashion as they are expressed with monadic second-order logic.

Education

2019-…   Ph.D. student at the MICS laboratory at CentraleSupélec, University Paris-Saclay.
Supervised by Pascale Le Gall, in collaboration with Agnès Arnould and Hakim Belhaouri from the XLIM laboratory (University of Poitiers).

2015-2019   **MSc in Engineering** at CentraleSupélec, top French graduate engineering school of University Paris-Saclay (https://www.centracentlesupelec.fr/).
Student-researcher in the context of the research program at the MICS laboratory. Majors in computer science and research. Internship: "Graph transformations to design geometric modeling operations" at the MICS laboratory, CentraleSupélec, University Paris-Saclay (France), under the supervision of Pr. Pascale Le Gall.

2017-2018   **MSc in Fundamental Computer Science** at Ecole normale supérieure top French graduate research-and-higher-education school of University Paris-Saclay (https://wikimpri.dptinfo.ens-cachan.fr/)
Algorithmics and Foundation of Programming (ex-MPRI). Research-oriented master. Internship: "User-assisted urban modeling by simulation of inner-city growth" at the HPCG laboratory, University of Purdue (USA), under the supervision of Pr. Bedrich Benes.

2013-2015   **Preparatory classes** at Lycée Louis-Le-Grand, Paris
Two-year undergraduate intensive course in mathematics and physics. Major in mathematics and option in computer science.

Teaching

2019-…   Teaching assistant at CentraleSupélec, France. For BSc/MSc students in Engineering.

Algorithmics   40 hours of tutorials (undergraduate)
Programming in Python   100 hours of tutorials (undergraduate)
Theoretical computer science 60 hours of tutorials and 5 hours of lectures (graduate)

Talks

- GReTA seminar. Combinatorial maps: transformations and application to geometric modeling. 24 September 2021. https://www.irif.fr/ greta/event/2021-sep-24/. Online
- Journées du GTMG (French event). 18 - 19 March 2021. https://gtmg2021.sciencesconf.org/. Online.
- Journées du GTMG (French event). 16 - 17 March 2022. https://gtmg202.sciencesconf.org/. Dijon, France. Accessit Prize.

Participation in events

- International School on Rewriting. 5 - 16 July 2021. https://dalila.sip.ucm.es/isr2021/. Online.
- Presentation of a poster at Eurographics. 25 - 29 April 2022. https://eg2022.univ-reims.fr/. Reims, France

Tool development

Contributor to java verison of the Jerboa platform. Jerboa is a platform that provides a solution to prototype topology-based geometric modeler. Operations are defined are rules, verified automatically by a static anayzer. The formal rules are converted to java code used to modify objects.
- Implentation of the topological anayzer
- Implentation of the rule inference, an automatic mechanism that reconstruct modeling operations from an example.

Technical skills

OSs   Windows, Linux
Programming languages   Python, Java, OCaml
Utilities   LaTeX, IDEs (VSCode, Eclipse), versionning (Git, SVN)

References

[Arnould et al., 2022] Arnould, A., Belhaouari, H., Bellet, T., Le Gall, P., and Pascual, R. (2022). Preserving consistency in geometric modeling with graph transformations. In minor revision in the journal Mathematical Structures in Computer Science.

[Pascual et al., 2022a] Pascual, R., Belhaouari, H., Arnould, A., and Le Gall, P. (2022a). Inferring topological operations on generalized maps: Application to subdivision schemes. *Graphics and Visual Computing*, 6:200049.

[Pascual et al., 2022b] Pascual, R., Le Gall, P., Arnould, A., and Belhaouari, H. (2022b). Topological consistency preservation with graph transformation schemes. *Science of Computer Programming*, 214:102728. doi:10.1016/j.scico.2021.102728.