Optimal Transportation Corridor Determination by Bottom-up Network Generation

J. González[1], J. Raimbault[1] and A. Banos[2]
[1] Graduate School, Ecole Polytechnique
[2] Géographie-Cités, UMR-CNRS 8504

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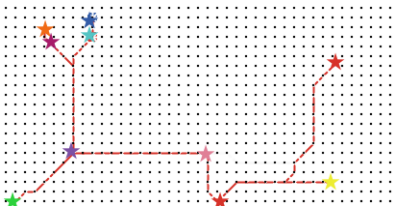
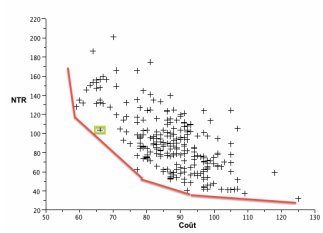
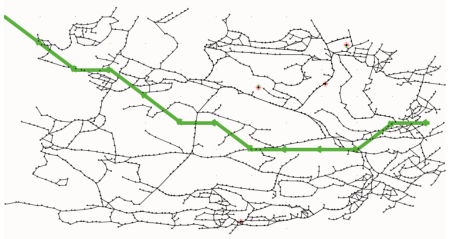
The question of multi-objective optimization of corridor path for a new project of transportation infrastructure remains a key issue in transportation planning and territorial intelligence. Many top-down approaches have already been tackled in the literature and are operationally mature. Also mixed top-down and bottom-up approaches such as Land-Use Transport Interaction models show a strong potential in sustainable design of new infrastructures [4, 2]. To compare corridor alternatives, we use a pure bottom-up approach for network self-generation [1]. In particular, this work is based on the model developed in [3], where slime-mold evolution is simulated in order to build a biologically inspired network with emergent robustness and efficiency properties. We constrain this model to take into account the preexistent road system as an exogenous parameter, and we assess the response of the system to the presence of the new infrastructure. After having internally validated the model and performed sensitivity analysis, we apply it first on an abstract situation, then on a real case with GIS data, proposing in both cases a bi-objective Pareto set of optimal solutions regarding robustness and efficiency of the generated network. The proximity of the obtained solution with the one actually proposed by planners validates externally the application of this bottom-up approach to the planning problem.



(a) Emergent Network in a homogeneous initial environment



(b) Pareto-Plot for bi-objective optimization



(c) Example of optimal corridor obtained on real GIS data with the constrained model

References

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