

Master Thesis

“Optimization models in software product line”

Software product line (SPL) engineering is a software engineering approach to building configurable software systems. SPLs are built around a set of common software components, which allow for customization. A product can be expressed with a feature-oriented structure. A valid combination of features is governed by a feature model, which defines relationships in a hierarchical manner. Features can be mainly mandatory or optional. Further relationships arise from requirements, mutual exclusion or a choice out of a set of features.

The goal of SPL is to find the best set of features, which is a valid combination and maximized at least one optimization function. Sayyad et. al (2013) used a genetic algorithm to find pareto optimal feature sets for up to five objective functions: to maximize logical (syntactic) correctness, maximize richness of feature offering, minimize cost, maximize code reuse and minimize known defects. Solving SPL problems is hard. More often than not heuristics from the field of Artificial Intelligence are used. Common technics are Genetic Algorithms, Evolutionary Strategies and Particle Swarm Optimization.

The objectives of this thesis are to...

- to review and systematically summarize the literature on Software Product Line exclusively for articles with optimization models,
- to compare and discuss the benefits and drawbacks of the different model categories,
- to highlight one model and point out their benefits to comparable models,
- to create an Integer Programming formulation or a genetic algorithm approach for a feature-driven optimization model in AMPL, and
- to provide open research gaps and future trends.

Basic Literature:

Guo, J., White, J., Wang, G., Li, J., & Wang, Y. (2011). A genetic algorithm for optimized feature selection with resource constraints in software product lines. *Journal of Systems and Software*, 84(12), 2208–2221. <https://doi.org/10.1016/j.jss.2011.06.026>

Sayyad, A. S., Menzies, T., & Ammar, H. (2013). On the value of user preferences in search-based software engineering: A case study in software product lines. In D. Notkin (Ed.) [proceedings (pp. 492–501). Piscataway, NJ: IEEE. <https://doi.org/10.1109/ICSE.2013.6606595>

Pohl, K., Böckle, G., & Linden, F. (2005). *Software Product Line Engineering: Foundations, Principles, and Techniques*. Berlin, Heidelberg: Springer-Verlag Berlin Heidelberg. Retrieved from <http://site.ebrary.com/lib/alltitles/docDetail.action?docID=10229377> <https://doi.org/10.1007/3-540-28901-1>