

Grammatical evolution (GE) is a recent grammar-based approach to genetic programming that allows development of solutions in an arbitrary programming language. Its existing implementations lack documentation and do not provide reproducible results suitable for further analysis. This thesis summarises the methods of GE and the standard methods used in evolutionary algorithms, and reviews the existing implementations, foremost the only actively developed one, GEVA. A new comprehensive software framework for GE is designed and implemented based on this review. It is modular, well-documented, portable, and gives reproducible results. It has been tested in two benchmark applications, in which it showed competitive results and outperformed GEVA 10 to 29 times in computational time. It is also shown how to further improve the performance and results by using techniques unsupported by GEVA, including new modifications to the previously published methods of bit-level mutation and “sensible” initialisation. The thesis and the software together form a solid foundation for further experiments and research.