

The Vienna Graduate School on Computational Optimization (VGSCO) is a joint research and training program of the University of Vienna, TU Wien, IST Austria and Vienna University of Economics and Business funded by the Austrian Science Funds (FWF). Its main goal is to give PhD candidates a comprehensive training in different areas of optimization with special emphasis on algorithmic and numerical aspects. It fosters scientific collaboration between the PhD students and their advisors representing a broad spectrum of topics and areas in the field of optimization.

The VGSCO currently announces a PhD position in the area of

### **Conic Relaxations and Fast Primal Methods for Mixed-Integer Nonlinear Optimization (University of Vienna, Supervisor: Immanuel M. Bomze)**

*The weakness of Lagrangian bounds in nonconvex optimization is notorious. It represents a major obstacle in implementation of efficient global optimization algorithms (e.g., branch-and-bound) for Mixed-Integer Nonlinear Optimization. By using techniques of copositive optimization, one can tighten these bounds; for some classes (no quadratic constraints, some variables binary), it has been shown that the copositive relaxation is even a reformulation, i.e. that the bounds are actually tight. For more general problems, this is not true, however there are highly active research efforts to identify conditions which ensure tightness.*

*In this dissertation project, we focus on quadratic optimization under mixed-binary and quadratic (including linear) constraints. Efficient dual bounds are complemented by efficient primal bounds, e.g. by powerful primal-feasible local optimization algorithms. Fast first-order procedures, ideally exhibiting finite convergence with realistic bounds on the Active-Set-Complexity à la Away-Step-Frank/Wolfe, can be a good complementation in this respect and would yield exact yet tractable methods with very few, and interpretable, hyperparameters to tune in a machine learning context.*

*The envisaged class of optimization problems to be studied in the thesis is varied enough to tackle many relevant NP-hard problems arising from real-world applications, e.g. in Social and Economic Sciences (including Finance), Natural Sciences, and Energy Optimization. Extensions to settings where uncertainty plays a significant role (distributional robustness for instance) seem to be accessible in this research program, too.*

*The candidates are expected to have a solid theoretical background in optimization theory, linear algebra, convex and numerical analysis, as well as strong computer skills, including considerable experience with implementation of algorithms.*

The advertised position is associated with the Vienna Center of Operations Research hosted by the Faculty of Economics, Statistics and Business Administration at the **University of Vienna**, in the Research Group of **Prof. Dr. Immanuel Bomze**. The successful candidate will become a member of the **Vienna Graduate School on Computational Optimization**. The duration of the employment is of 3 years with possibility of extension. The extent of employment is 30 hours per week. The annual gross salary is approximately 31,000 €. The planned start of the position is autumn 2020.

#### **Application Requirements and Procedure**

The candidates must have a master degree (or equivalent) in *Mathematics, Operations Research or Statistics* (or comparable fields) at the moment the PhD position starts. The application documents should contain a letter of motivation; the scientific CV with publication list, if available; higher education certificates/diplomas; the diploma/master thesis and letter(s) of recommendation. Applications have to be submitted at: [vgSCO.univie.ac.at/positions/application](http://vgSCO.univie.ac.at/positions/application). The deadline for applications is **June 15, 2020**.