Phillippe Samer, PhD

Brazilian, 37 years, married, permanent residence in Norway
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Software developer with strong analytical skills for the thorough inspection and replacement of computational bottlenecks in complex critical systems. Expertise in optimization and the design and analysis of algorithms. Experience in supporting interdisciplinary teams in planning and quantitative logistics (*prescriptive*, not *predictive*, business analytics) for efficient operations research and problem solving in healthcare, transportation, mining and bioinformatics.

Programming languages: Java, C++, Python, C#, bash, JavaScript.

Mathematical programming: mixed-integer linear programming modeling; exact optimization with Gurobi, CPLEX, Google OR-Tools and COIN-OR solvers; approximate optimization with metaheuristics (neighborhood search) and matheuristics (model-based heuristics).

Libraries and tools: linear algebra and graphs in C++ (Eigen, LEMON), parallel programming in C++ (OpenMP), data science (numpy, scipy, pandas, NetworkX), web scrapping and REST APIs in Python (urllib, requests, Flask), refactoring of JS components and bug-tracking across a full stack (React, jQuery, Bootstrap, postgreSQL), version control (git), test-driven development (pytest, Catch, JUnit, GitHub Actions).

1 Experience

1.1 University of Bergen, Norway

Staff Engineer at the Computational Biology Unit

Jan. 2023 – Present

⋆ C++ (Eigen, OpenMP, Catch) ⋆ Python (Flask, urllib, requests, numpy, scipy, pandas, pytest) ⋆ JS (React, jQuery) ⋆ git, GitHub actions

Two major projects rewriting large data science code bases and pipelines in bioinformatics, focusing on maintainability with modular design and TDD.

In the first, a prototype consisting of several intertwined Jupyter notebooks was ported into a stand-alone Python package, separating concerns (including web-scrapping, RESTful APIs, and scientific computation) and fixing broken pieces in the data pipeline, enabling a new PhD candidate to work with the methods developed by a previous postdoc researcher.

In the second, a complex Matlab prototype using decades-old numerical routines was ported into C++ using the Eigen template library for linear algebra. The work-in-progress shall enable the high-performance computing both in multi-core CPUs using OpenMP and in multi-node clusters using MPI with negligible overhead.

Promoted good coding practices in the academic group, including SOLID principles, version control, and setting up CI/CD infrastructure.

Research Fellow at the Department of Informatics

Jan. 2019 – Dec. 2022

⋆ C++ ⋆ Optimization (Gurobi, COIN-OR Vol, LEMON) ⋆ Python (NetworkX) ⋆ Perl (polymake) ⋆ git, bash

Carried out 3 independent research and development projects with minimal supervision, finding out necessary answers and managing my work duties in all phases from brainstorming and coding to experimenting and writing. Started and led a successful cooperation with an external researcher at KU Leuven, Belgium.

The investigation focused on the mathematical structure and algorithms for selected models behind network topology/design problems that arise in planning and quantitative logistics (e.g. within telecommunications, utilities, facility location). Contributed improved methods and integer programming formulations to identify an optimal structure in each of the models, assuming the elements that form them (vertices or edges in a given graph) have a weight. Shared the open-source implementation of all algorithms and tools, developed with efficiency and modular design in mind, thus fostering reuse, further research and new applications in research and development. Full implementation available in GitHub repositories.

Published 6 international research articles, gave 2 talks in international conferences, serving as session chairperson in both.

Fully responsible for delivering a masters course in optimization (INF271 – Combinatorial Optimization, 10 ECTS credits).

1.2 Molde University College – Specialized University in Logistics, Norway

Guest Researcher

Nov. 2015 – Apr. 2016

`⋆ C++` `⋆ Optimization (Gurobi, LEMON, model-based heuristic)` `⋆ bash`

Research and development on a combinatorial optimization problem arising in maritime logistics: planning the assignment of berthing position and time, plus a number of quay cranes, for arriving vessels in a seaport container terminal.

Used graph theory to develop new techniques: lower bounds on an optimal solution, a variable reduction preprocessing method, and a model-based heuristic. The resulting method finds known optimal solution in 83% of the available benchmark instances, using only 30% of the computing time. In the remaining instances, it provides a solution within 4% of the known optimal known cost.

Published 2 international research articles, gave a talk in an international conference.

Contract funded by the Norwegian Research Council, Project 227084: Port-Ship Coordinated Planning.

1.3 In Optima Consultoria, Brazil

Co-founder and scrum master

Nov. 2014 – Nov. 2016

Initiated the business consultancy startup, recruiting the 4 other members. Headed the admission into seed accelarator and mentorship program Incubal (*Incubadora de Empresas de Alagoas*, Brazil) throughout 2015. Headed all meetings with clients in mining, transportation and healthcare sectors. Managed project development in an agile scrum-like methodology.

Consultant at TimeFiler, Christchurch, New Zealand

Aug. 2016 – Nov. 2016

`⋆ C#` `⋆ Optimization (Gurobi)`

Analysis and correction of the underlying optimization model for a nurse rostering software developed at TimeFiler. Thorough revision and correction of the existing formulation, and implementation of new constraints concerning (i) required skills for each shift, (ii) days off between shifts of each employee, and (iii) balancing the workload among employees. The delivery consisted of both the code updates and a technical report standardizing notation and the optimization model, including the mathematical justification for significant changes.

Consultant at Vale S.A., Brazil

May 2015 – Jul. 2015

`⋆ Python` `⋆ Optimization (Gurobi)` `⋆ git`

Implementation of a mathematical programming model for the mining production chain in Ouro Preto (Minas Gerais, Brazil). Funded by a research and development project at the Vale Institute of Technology – ITV.

Analyzed and confirmed the viability of the model for planning drilling operations in the open-pit mine so as to minimize the daily variability of quality parameters in the sequence of iron ore blocks sent to the associated processing plants. Implemented additional constraints in the existing model, to include (i) precedence/sequencing relations between land blocks on different depth levels, and (ii) minimum activity level of the associated mineral processing facility.

Consultant at Vale S.A., Brazil

Nov. 2014 – Dec. 2014

`⋆ Python` `⋆ Optimization (Gurobi)`

Prepared and delivered a 1-week training course for a research and development team at the Vale Institute of Technology (ITV), covering the usage of the Gurobi optimization solver and the necessary Python background.

The contract also included a software development component, and we delivered the implementation of three tailored matheuristic frameworks, *i.e.* heuristics that probe an integer programming model when serching for good solutions to a computationally challenging optimization problem.

Consultant at Santa Casa de Maceió, Brazil

Jul. 2015 – Sep. 2015

`⋆ Python` `⋆ Optimization (COIN-OR cbc, Google OR-Tools, heuristics)` `⋆ git, bash`

Developed a case study for improved support to face nurse scheduling challenges at the hospital – ranked fourth among healthcare corporations in Brazil in 2014, and member of the "Qmentum Global" accreditation program in Canada.

Worked closely with different stakeholders, using past data and schedules to propose a mathematical model and a prototype implementation that met the hospital demands and the labor law, while minimizing the costs with over-hours and contract-nurses. The small case with 30 nurses showed that the model could find feasible solutions of proven minimum cost, out of the 170.000 possible schedules.

The case study concluded that the approach satisfied the objectives of better meeting nurse preferences, reducing financial burden, and advancing in ISO certification, but the project continued with larger consultancy houses.

Consultant at PickMeApp, Brazil

Nov. 2015 – Feb. 2016

`⋆ Python` `⋆ Optimization (Google OR-Tools, heuristics)`

Managed the case study for a startup developing a mobile app for shared rides between clubs and pubs in Belo Horizonte, Brazil. Together with one more member at In Optima, held meetings to agree on a data exchange protocol and designed algorithms for a real-world vehicle routing problem, further complicated with constraints for (i) dynamic data availability, (ii) vehicle capacity, (iii) time-windows, and (iv) pickup and delivery pairs.

Next, I only supported (as scrum Product Owner) the development by three other members of our team, which consisted of a Node.js server, and a Python optimization solver using data from the Google Directions and Distance Matrix APIs.

The case study was interrupted by the client, which decided on a different business model to develop a minimum viable product through the next quarter.

Consultant at LCC CENAPAD-MG – The National Center for High-Performance Processing, Brazil

Jul. 2014 – Oct. 2014

⋆ `C++` ⋆ `Optimization (GLPK, AMPL)` ⋆ `bash`

Implementation of an exact model to optimize the distribution of medical specialists workforce across all regions of Brazil. Funded by a pilot project of the LCC CENAPAD-MG to inform the policies of the Ministry of Health in the Mais Médicos program.

The delivered prototype received traveling costs information and municipality data concerning the supply of and demand for medical specialists, and prescribed the best assignment (in numbers) of specialists between municipalities so as to provide an uniform service across the country and minimize traveling costs.

1.4 Federal Center for Technological Education of Minas Gerais (CEFET-MG), Brazil

Assistant Professor

Mar. 2015 – Jan. 2016

⋆ `C++` ⋆ `Python` ⋆ `MATLAB/Scilab`

Responsible for undergraduate courses on Numerical Analysis, Algorithms and Data Structures I, and Algorithms and Data Structures II. Taught a number of audiences within computer science, civil engineering, electrical engineering and materials science curricula.

1.5 Pontifícia Universidade Católica de Minas Gerais, Brazil

Assistant Professor

Aug. 2014 – Jul. 2015

Responsible for undergraduate courses on Linear Optimization, Graph Theory, Algorithms and Data Structures I, and Algorithms and Data Structures II for computer science and information systems curricula.

1.6 National Council for Scientific and Technological Development (CNPq), Brazil

Research Assistant

Mar. 2014 – Aug. 2015

⋆ `C++` ⋆ `Optimization (CPLEX)` ⋆ `R`

Research assistant on the design and analysis of models for energy disaggregation and pricing problems. Funded by the Smart Grid Technology call for research and development projects of the CNPq, in a cooperation between universities and two energy companies in Brazil (Eletrobras and OFM Sistemas Ltda).

Analyzed a non-intrusive load monitoring model based on information theory methods, so as to identify individual signatures of electrical appliances, both for the benefit of end-user information and to identify illegal load diversion for the electricity operators. Implemented ETL methods to handle the Reference Energy Disaggregation Dataset and feed statistical inference pipelines in R.

Contributed subsequently to the economic viability analysis, investigating the *envy-free pricing* model to prescribe energy sales prices that simultaneously allow optimizing the profitability of an operator in the market competition and satisfy the cost-benefit expectations of consumers. Completed a review of variations of the problem and of optimization algorithms for its solution.

1.7 MAV Tecnologia, Brazil

Software Engineer

Sep. 2011 – Jan. 2012

`⋆ Java` `⋆ Lua` `⋆ git`

Development of extensions across the full stack of an email security system.

Updated different modules of a model-view-controller architecture, including performance indicators in the user interface (using the Google Web Toolkit with Java), and parsing of firewall and email traffic logs (from servers coded in Lua).

1.8 Sigma Plus ATS, Brazil

Software Engineer

Jul. 2010 – Dec. 2010

`⋆ Perl` `⋆ Apache Subversion`

Implemented new features in a system for automatic information retrieval, feeding both the automated trading system bots and the marketing team in the company with targeted advertisement information.

Updated a collection of Perl scripts for web scrapping and data ETL, contributing with enhanced parsing methods to process collected pages using regular expressions and XPath.

2 Education

Jan. 2019 – Dec. 2023: Philosophiae Doctor (PhD) in Mathematics and Natural Sciences, **University of Bergen**, Norway.

PhD Thesis: Polyhedra and algorithms for problems bridging notions of connectivity and independence.

Aug. 2017 – Nov. 2018: Postgraduate Certificate (Specialist Degree) in Pure Mathematics, **Universidade Federal de Minas Gerais** (UFMG), Brazil.

Mar. 2012 – Fev. 2014: M.Sc. in Computer Science, **Universidade Federal de Minas Gerais** (UFMG), Brazil.

Master's Thesis: Formulations and exact algorithms for the minimum spanning tree problem with conflicting edges pairs.

Exchange: **Hokkaido University**, Japan. One of 3 students recommended by the consulate general of Japan in Rio de Janeiro for the Monbukagakusho/MEXT Scholarship for young researchers.

Aug. 2005 – Jul. 2011: B.Sc. in Computer Science, **Universidade Federal de Minas Gerais** (UFMG), Brazil.

Degree work: Automatic parallelization of ant colony optimization with MapReduce (in Portuguese).

Exchange: **Hochschule Ulm**, Germany.

3 Language proficiency

Portuguese, mother tongue
Oral: excellent
Written: excellent

English, C2-level
Oral: excellent
Written: excellent

Norwegian, C1-level
Oral: good
Written: excellent (both bokmål and nynorsk)

Spanish, B1-level
Oral: good
Written: good

Japanese, A2-level
Oral: some
Written: some

4 References

Marco Túlio Reis Rodrigues – Software Engineer at Microsoft, Seattle, USA

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Sebastián Urrutia – Professor at Høgskolen i Molde, Norway

Supervisor during Masters degree; code revision in several projects

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