

Master's Research Internship in Operations Research

Topic: Assortment Optimization in Mass Retail

Keywords: Operations research, multi-criteria optimization, heuristics, machine learning

• Research Context and Objectives

In this project, we focus on the *assortment optimization problem* (AOP). More specifically, given a very large number of products, retailers must select a limited number of products consisting of basic items, trendy products, etc., in order to both better meet customer demands and achieve commercial objectives. To this end, several criteria, e.g., product availability, prices, customer preferences, support for regional/local producers, etc., must be taken into account. Depending on the total number of products available and the size of the goods to be selected, there will be an exponential number of combinations. In this context, the assortment optimization problem consists of making the best choices among all possible combinations, taking into account various constraints. This problem can be modeled in the form of mathematical optimization models that are computationally challenging for large instances.

Since the optimal solution of a POA can contribute to the economy by maximizing revenue, to sustainable development by minimizing waste, etc., in this internship project, we are interested in POAs with multiple criteria, e.g., maximizing revenue, maximizing customer satisfaction, etc., under practical constraints, e.g., the limited number of final choices, limited capacity of stores/supermarkets, etc.

After modeling the problem in the form of mathematical optimization models, we plan to develop efficient solution algorithms. In this context, the focus will be on hybrid algorithms that are based on an effective combination of heuristic methods and machine learning approaches.

The algorithms will then be implemented and tested on benchmark data sets. Furthermore, we are interested in the design and implementation of a user-friendly graphical user interface (GUI) to simplify the use of the technology developed within this project.

• Potential PhD Thesis: Successful accomplishment of this internship can lead to a PhD thesis at the University of Evry Paris-Saclay.

Here is an outline of the internship:

- Literature review on the existing papers and models related to AOP.
- Mathematical modeling of the AOP.
- Design and implementation of efficient algorithms to address the AOP.
- Conducting computational experiments to test the performance of the introduced algorithms using benchmark instances.
- Design and implementation of a graphical user interface.
- Writing of a final report.

By the end of the project, the intern should provide all materials, i.e., codes, data, results, and report and presentation files.

• Required Profile and Skills

We are looking for a final-year engineering or master's student having the following characteristics:

- Holds required degree and qualifications in operations research, computer science, applied mathematics, or in any other closely-related field.
- Has a good knowledge in machine learning and in operations research (mathematical optimization, algorithm analysis, exact algorithms, heuristics, and metaheuristics).

- Has excellent computer programming skills in Python. Experiences with optimization solvers, e.g., Gurobi, Hexaly, etc. is not compulsory, but it is desired.
- Has good organizational and communication skills.
- Has excellent communication and writing skills in English.

• Supervision and Location

The internship will jointly supervised by the researchers from:

- the research lab. IBISC (Informatique, Bioinformatique, Systèmes Complexes) at the University of Évry Paris-Saclay
Address of the *IBISC*: Bâtiment IBGBI – 2ème étage, 23 Boulevard de France, 91034 Évry, France
- the ensiIE (Ecole Nationale Supérieure d’Informatique pour l’Industrie et l’Entreprise)
Address of the *ensiIE*: 1 Place de la résistance, 91000 Évry, France

Both institutions are located at the center of Évry, within 10-minute walk distance from each other. Évry is located at 20km distance from Paris, reachable by RER D, etc.

• Contact Information and Application Process

Supervisors:

- Feng CHU (feng.chu@univ-evry.fr), Full professor at the University of Évry Paris-Saclay
- Mahdi MOEINI (mahdi.moeini@ensiie.fr & moeini.mahdi@gmail.com), Associate professor at the ensiIE and affiliated to the research lab. SAMOVAR of the Télécom SudParis

Application: (Please send the following documents as a single pdf file to both supervisors)

- Motivation letter (at most one page)
- Detailed Curriculum Vitae (maximum 2-4 pages)
- Academic transcripts (Bachelor and Master levels)
- Contact information of two academic references

Duration: 5-6 months

Start Date: February or March 2026

Honorary: Standard internship stipend according to the French regulations

Application Deadline: the position remains open until we find the suitable applicant

• Last but not least:

- Only applications including all required documents will receive full consideration.
- Only shortlisted applicants will be contacted for an interview.

• Some references

- [1] Leitner, M., Lodi, A., Roberti, R., & Sole, C. An Exact Method for (Constrained) Assortment Optimization Problems with Product Costs. *INFORMS Journal on Computing*, 36(2), pp. 479-494, (2024).
- [2] Le Zhang, Shadi Sharif Azadeh, Hai Jiang. Exact and heuristic algorithms for cardinality-constrained assortment optimization problem under the cross-nested logit model. *European Journal of Operational Research*

324, pp. 183–199, (2025)

