

# Progress Report

Simon Sepiol-Duchemin

June 30, 2025

## 1 Research Objective and Goal

The objective of this study is to improve the booleanization part of algorithm from Truong et al. (2021). Starting with understanding the nonnegative matrix factorization problem and algorithms to solve it.

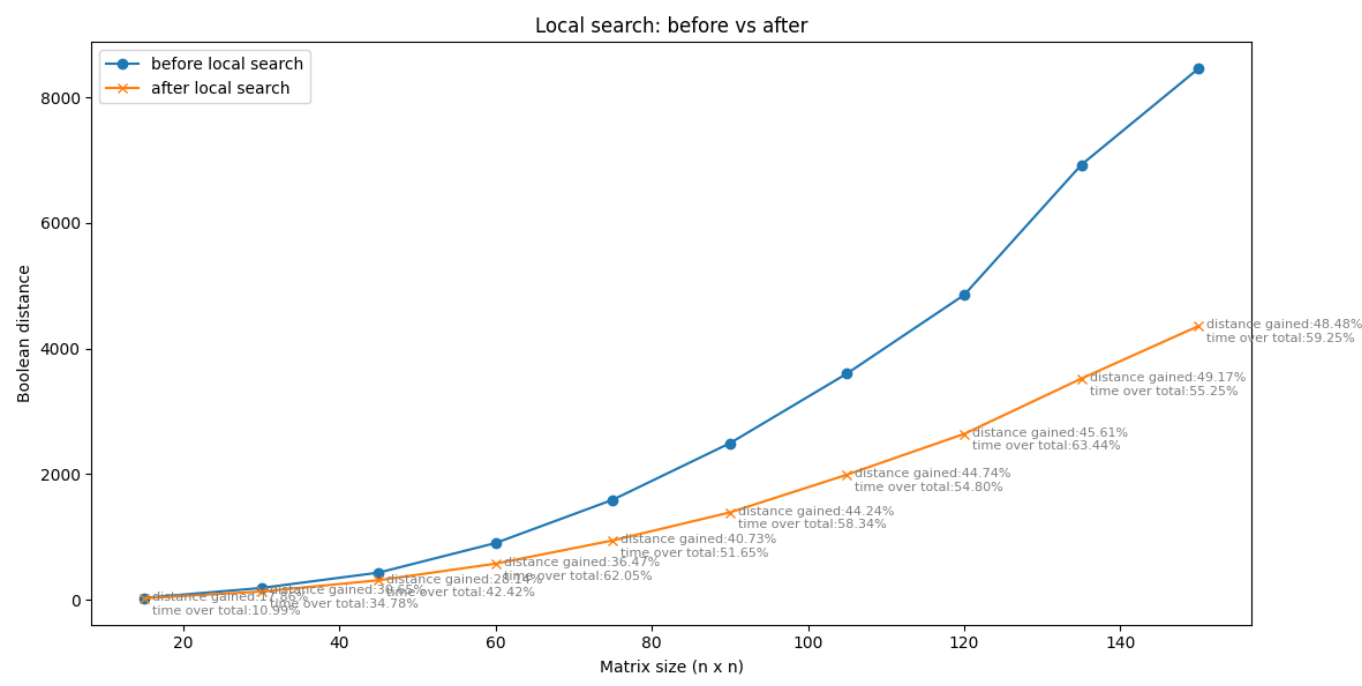
## 2 Short-Term Goals

1. Compare the result of implementation of the banmf algorithm of Simon and Yamada Kento.
2. Implement the brute force algorithm
3. Implement the local search algorithm

## 3 Progress

1. We have compared our codes, they give the same result.
2. I have implemented the brute force algorithm
3. I have implemented the local search algorithm.
4. I tried to optimize it by computing only the dot product of the other matrix with the row or column of the changed entry. The theoretical complexity of one iteration of the optimized version should be  $O(2mnk + n^2km + nmk^2 + m^2kn + 2k^2mn)$  and  $O(n^2k^2m + n^2km + m^2k^2n + m^2kn)$  for the non optimized one. The difference of the two is  $O(n^2k^2m + m^2k^2n - 2(mnk + k^2nm))$ .

# 4 Results



# References

Truong, D. P., Skau, E., Desantis, D., and Alexandrov, B. (2021). Boolean matrix factorization via nonnegative auxiliary optimization. *IEEE Access*, 9:117169–117177.