

Solving vehicle routing problem with mathematical programming

CHALLENGES: optimizing vehicle routing during fuel delivery

PRODUCTIVE SECTOR: logistic

MATHEMATICAL AND COMPUTATIONAL METHODS

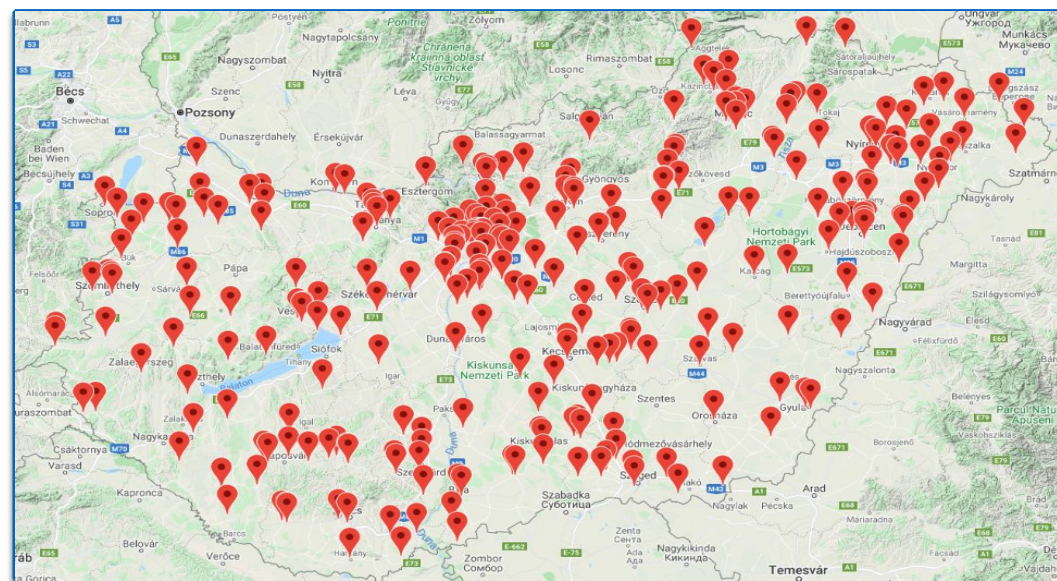
PROBLEM DESCRIPTION

MOL serves hungarian clients with gasoline and diesel products. The company wants to evaluate and optimize vehicle routing during fuel delivery.

- The problem is formulated as a mixed integer linear programming problem.
- Distance and time matrices were obtained by scripting OpenStreetMap.
- To reduce the size complexity of the models the active clients were clustered by machine learning.
- The MILP models were formulated and solved by FICO-XPRESS.

CHALLENGES AND GOALS

The main KPI used by the company is the transported litre/km value. The aim of MOL is to improve this KPI.



Location of the clients that have to be served on a given day.

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Results and Benefits

- A MILP based approach combined with clustering was developed.
- The models were tested on problems of the company.
- For small instances it gave the optimal solution.
- In 10 cases we achieved better result than the company.
- Our method also gives a lower bound on the optimum.
- The method can be applied to medium-size problems.

The developed method can give optimal solution for small instances (for example in the night shifts) and it may outperform the software of the company in medium size problems. **The method gives a lower bound on the optimum.**



Comparing the models with different cluster size

case	1.	2.	3.	4.	5.	6.	7.	8.
SZE-KPI	0.7	0.68	0.6	0.7	0.57	0.51	0.82	0.6
MOL-KPI	0.66	0.73	0.68	0.6	0.53	0.47	0.74	0.54
case	9.	10.	11.	12.	13.	14.	15.	
SZE-KPI	0.68	0.48	0.38	0.55	0.57	0.86	0.52	
MOL-KPI	0.58	0.55	0.5	0.45	0.59	0.67	0.49	

Results of the new method and Results of MOL are compared



MOL GROUP