# Algorithmus Schmiede

We develop computer programs that solve complex tasks.

**Data Science**

**Numerics**

**Physics**

# Project Reference:
# Complex Optimization Tasks

# Algorithmus Schmiede

We develop computer programs that solve complex mathematical / technical tasks.

Our employees have a doctorate in natural sciences. We program in **Python** and **C++**.
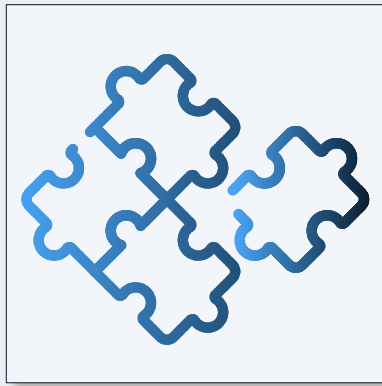
**You benefit** from:

- Algorithms with maximum reliability
- A deep understanding of physical relationships
- Scientific way of working

# Complex Optimization Tasks

Solution of complex optimization tasks
that can no longer be solved with standard optimization libraries.

Contents:

- Modeling of a problem that is difficult to describe in a clear mathematical structure

- Clear visual presentation of the problem and the algorithm

- Selection of a suitable optimization method:
  Either use of library functions or individual implementation

- Development of suitable benchmarks for evaluating the optimization result

# Example: Area Optimization

Division of new development areas into individual plots of 500 m$^2$ each with a sensible aspect ratio.

➲ Immediate estimation of the development costs.

Contents:

- Modeling as a graph

- Multi-stage optimization procedure using:
  Monte Carlo (Metropolis-Hastings), Simulated Annealing, mod. Dijkstra, ...

- Implementation via REST-API on AWS (Amazon Web Services):
  API gateway + Lambda + RDS (Relational Database Service)

Challenges:

- Finding further (previously unspecified) optimization criteria
  (e.g. arrangement along alignments, drive-through capability)

- Computing time < 15 sec

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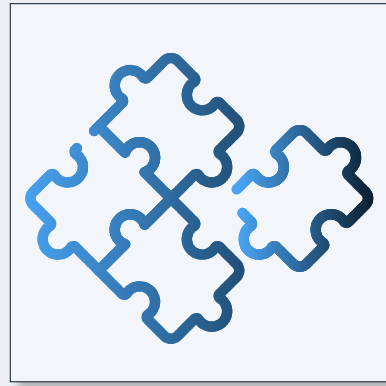
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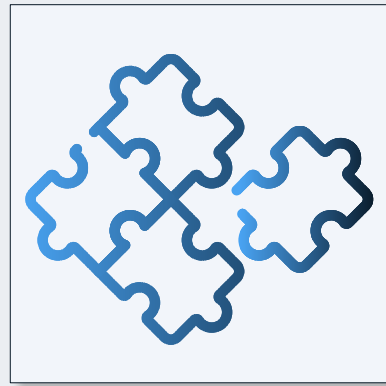
# Example: Area Optimization



Starting Situation:

- total area

- road connections



Step 1:

- establishing basic road connectivity

- while avoiding acute angles

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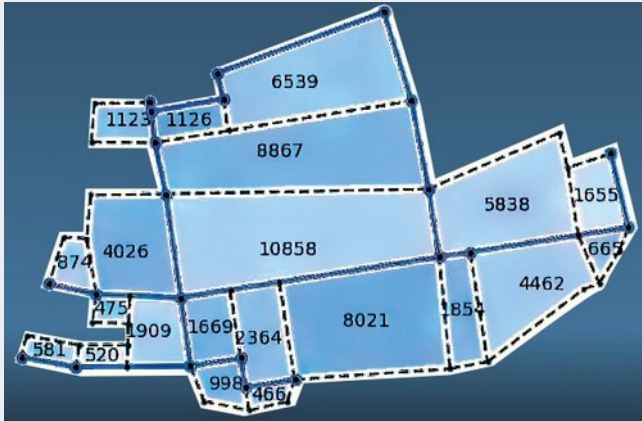Data Science | Numerik | Physik ©

# Example: Area Optimization
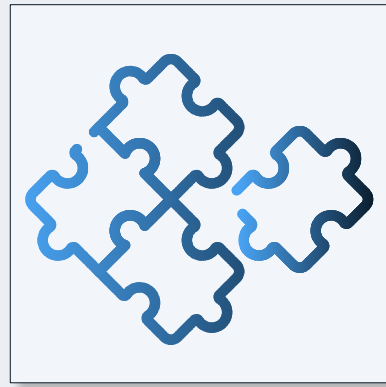


Step 2:

- Decomposition into (almost) rectangular sub-areas

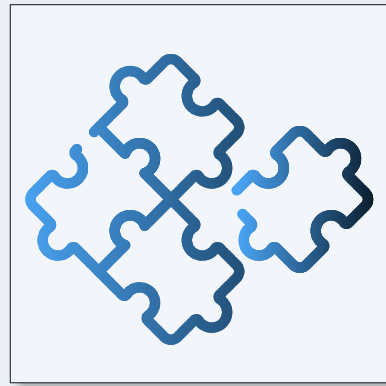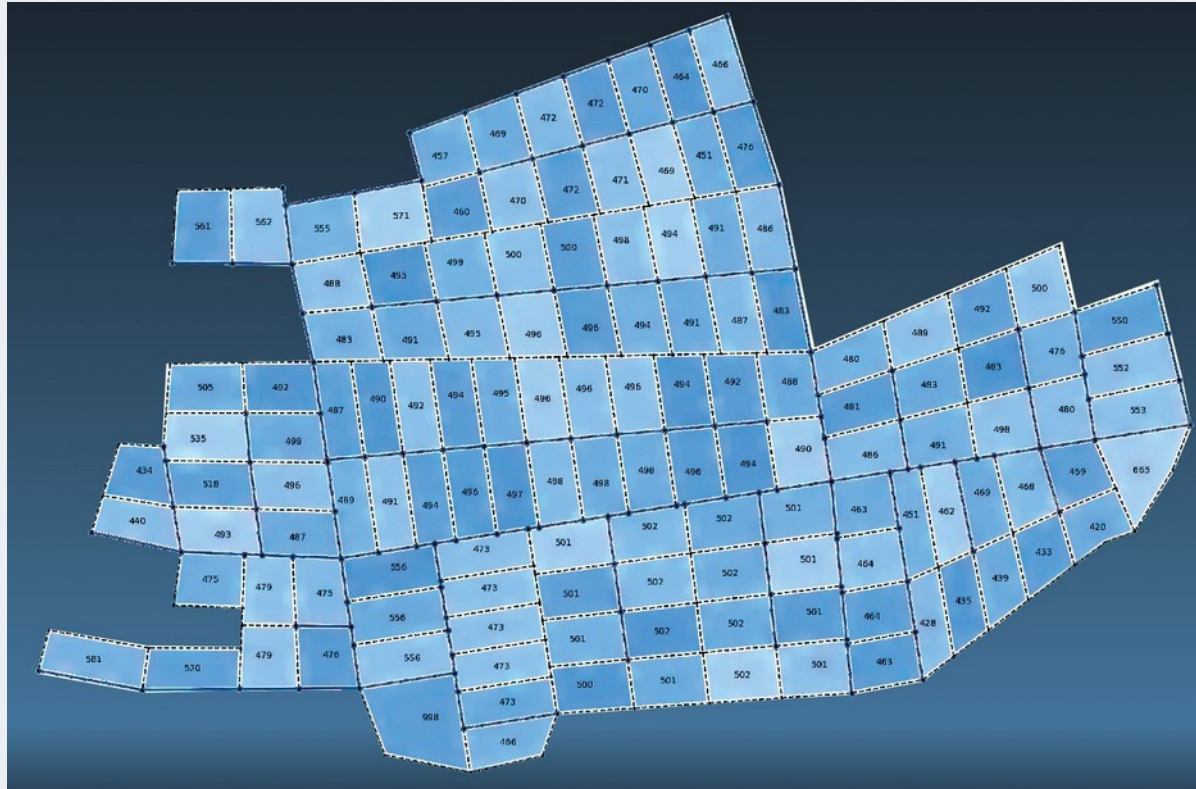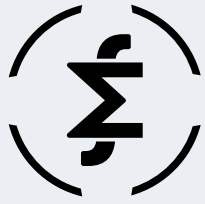- Optimized insertion of new edges and nodes into the graph



Step 3:

- Connection of all sub-areas to the road network

- Modification of the Dijkstra algorithm (many start points & several end points possible)

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# Example: Area Optimization

Final result:

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## Stay tuned:

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I am happy to advise you on your project idea.

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