MULTIOBJECTIVE GENETIC DISCOVERY OF DRIVING STRATEGIES

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Problem Description

• Vehicle driving on a route from location A to location B
• Vehicle defined with:
  – engine characteristics
  – transmission characteristics
  – aerodynamic characteristics
  – braking characteristics
  – wheel characteristics
• Route consists of segments
• Segment defined with:
  – length
  – inclination
  – radius
  – velocity limit

Goal

• Find driving strategies regarding two objectives that have to be minimized:
  – traveling time
  – fuel consumption
• Find set of strategies:
  – not worse with respect to both objectives
  – heterogeneous with respect to both objectives

Representation of Driving Strategies

• Strategies as sets of rules
• Rule form:
  – IF vehicle characteristics INSIDE interval1
  AND segment characteristics INSIDE interval2
  THEN
  USE throttle percentage AND gear
  OR braking percentage

Solving the Problem

• Find strategies with a multiobjective genetic algorithm based on NSGA-II
• First, random initialization of strategies
• Then, strategy improvement step-by-step, in each step:
  – randomly select two strategies and two rules of these strategies
  – exchange information between the selected rules
  – randomly change the rules
  – delete a randomly selected rule
  – add a randomly created rule
  – evaluate the obtained strategies
  – add these strategies to the set of existing strategies
• Periodically remove the worst and too similar strategies with respect to the objectives

Solutions for a given route found in five experimental runs

Car driving interface