Evolutionary Algorithm with Recombination Hotspots

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Objective - Optimization

• Find the “best” solution under some conditions/requirements

• Situations:
  • Different cost for the Same Effect
  • Different return for the Same Investment budget

• Find the most cost-effective decision
  • Minimizes costs, and/or
  • Maximizes benefits
Traditional Method - Differentiation

• Approximates the change of objective function
  • Evaluates where the performance does not improve anymore

• Examples:
  • Gradient Descent (Greedy Hill-Climbing)
  • Lagrange Multiplier
Comments on Traditional Methods

• Pros:
  • Convergence generally fast
  • Computationally (relatively) inexpensive
  • Solution often acceptable

• Cons:
  • Can only find local optimum close enough
  • No progress after reach a local optimum
Genetic Algorithm

• Global search (with randomness) in solution space
• Idea: Darwinian Evolution – Survival of the fittest
  • Less cost / greater benefit are “stronger” individuals
  • Favors selection and reproduction
  • Useful traits (properties) are preserved and evolved
• Diversity
  • Effective coverage of population
  • Prevents premature convergence (domination of local optimum)
Solution Encoding

• Haploid
  • A single vector
  • Suitable for static environment

• Diploid
  • Two vectors
  • Performs well in dynamic environment
  • Provides implicit “memory” of unused traits
  • Needs decoding scheme (Dominance mapping)
Recombination Hotspots

• Regions where crossover occurs with high frequency
• Results in Modularity
  • Internal structure separated into independent parts
  • Swapping of genetic materials on a modular level
  • Promotes reusability of parts, each for dedicated function
• Evolvability is suspected to be related to hotspots
• E.g.: Chimpanzee and human