Quantum-Inspired Evolutionary Algorithms

Robert Nowotniak, MSc

Supervisor: Jacek Kucharski, DSc, PhD, MSc

Computer Engineering Department
Technical University of Lodz

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Outline

1. State of the art and scope of my research
2. Quantum elements in evolutionary algorithms
3. Theoretical analysis
4. Numerical experiments
Scope of research

Quantum Computing

Quantum Evolutionary Computing

Evolutionary Computing
Scope of research
Scope of research

Quantum-Inspired Evolutionary Algorithms

Quantum Computing

Quantum Evolutionary Computing

Quantum Evolutionary Algorithms

Quantum-Inspired Evolutionary Algorithms

vQEA
QiGA
GAQPR

Evolutionary Computing
Quantum elements in evolutionary algorithms

1. Representation of solutions
   Instead of exact points in a search space – *probability distributions* of sampling the space

2. Initialization

3. Genetic operators

4. Fitness evaluation
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Banach fixpoint theorem
It is possible to define a new measure of quality for quantum genotypes and relevant metric space where the algorithms converge to optimum solutions.

Holland’s schema theorem
Generalization of the theorem to the quantum-inspired genetic algorithm.

Markov chains
Analysis of the quantum-inspired evolutionary algorithm as a Markov process.

Walsh transforms
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4. **Walsh transforms**
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Walsh transforms
Numerical experiments

- Methodology proposed by De Jong (1975)\(^1\)
- Test functions (Rosenbrock, Schwefel, Rastrigin, ...)
- Combinatorial optimization problems:
  - traveling salesman problem, knapsack problem,
  - feature selection problem\(^2\)

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Thank you for your attention