Utilizing Lamarckian Evolution and the Baldwin Effect in Hybrid Genetic Algorithms

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Outline

- Genetic Algorithms
- Local Improvement
- Baldwin Effect
- Lamarckian Evolution
- Hybrid Genetic Algorithms
- Problems/Experiment
- Results and Conclusions
- Questions

Genetic Algorithms

- A powerful set of global search techniques
- Most use Darwinian evolution
  - Survival of the fittest
- Genotype maps to a phenotype
- Phenotypes are evaluated for fitness
- Genotypes with highest fitness allowed to reproduce

Local Improvement Procedure (LIP)

- From a given phenotype, search the area around it for better solutions
- Gradient Descent
- BackProp
- Good search but can get stuck in local minima

Baldwinain Effect

- Use LIP to determine the fitness, but mutate the original genotype
- Finds the genotype that has best future if trained

Lamarckian Evolution

- Uses LIP to determine fitness
- New phenotype is also the new genotype that will be mutated and crossed
- Parents can essentially pass a life-time of learning to children

Hybrid Genetic Algorithms

- After each mutation step, LIP is performed and depending on evolution style (Lamarckian and Baldwinian or Darwinian), train or don't
- If you train, choose what the genotypes to be crossed and mutated are

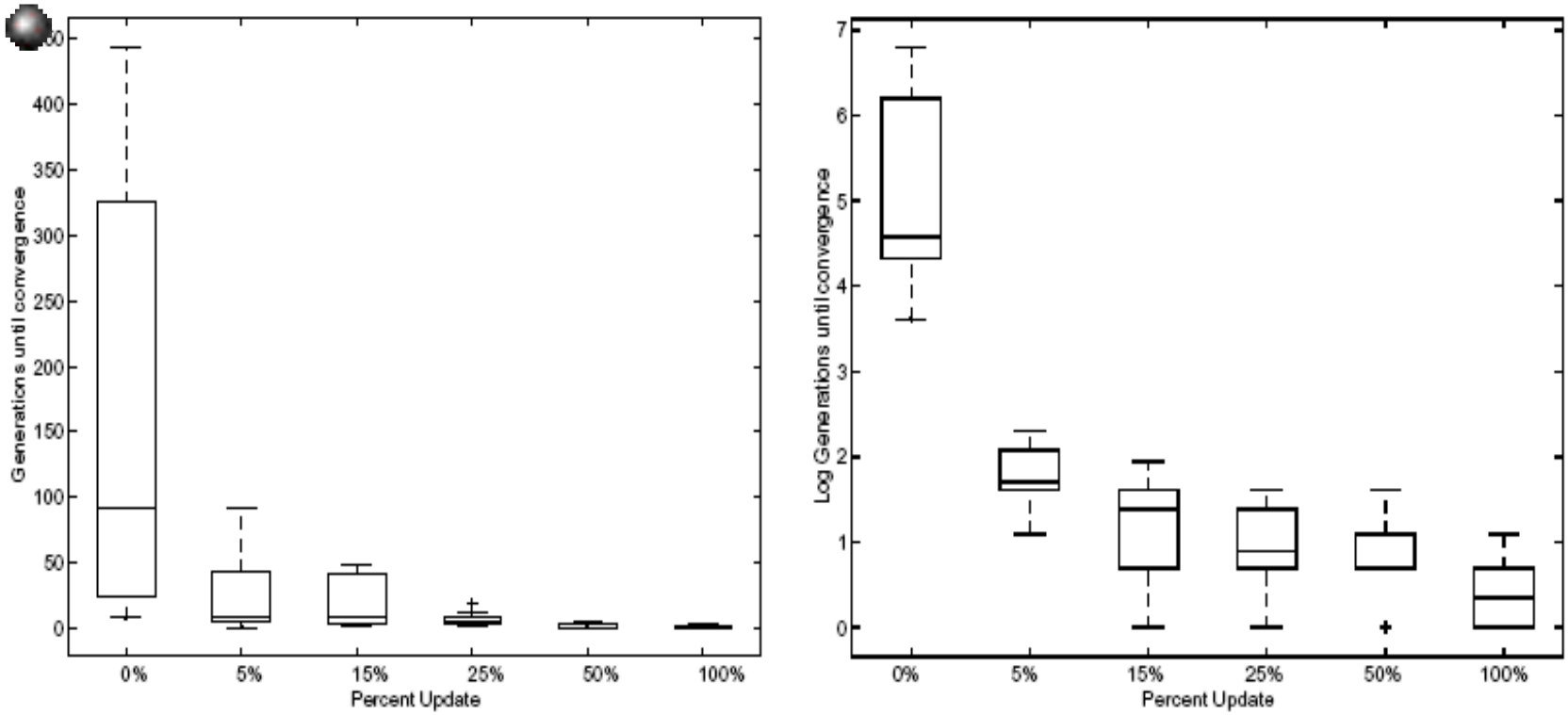
Problems

- Corona Problem
- Location Allocation
- Cell Formation

Experiment

- Run without LIP
- Run with only Baldwinian
- Run with combinations of Baldwinian and Lamarckian
  - Choose between the two probabilistically
- Run all Lamarckian

Results



(a) King Data Set

(b) Chan. Data Set

Fig. 3. Convergence for Cell Formation Problems

Conclusion

- Lamarckian evolution with the GA greatly improves best solution and reduces search time
- Balwinian also improved but not as much

Questions