Interactive Evolutionary Computation - IEC

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Content

1. Evolution and evolutionary Algorithm

2. Interactive Evolutionary Computation (IEC)

3. Applications of IEC
Evolution

Evolution is the change in heritable character of biological population.

- Charles Darwin

Types:

- Natural Selection.
- Artificial Selection.
Natural Selection

Natural Selection is a process by which the organism adapts to the environment survives.

Three main point in this type:

- Resource
- Inherit qualities
- Varies from others in same generation
Natural Selection (Cont.)

Artificial Selection

The breeding of plants and animals for different traits.

Examples:

- Flower
- Animals
Evolutionary Computation

- Selection
- Crossover
- Mutation
Evolutionary Creatures

Karl Sims

Environment

- land
- water

Source: http://www.karlsims.com/evolved-virtual-creatures.html
Description of the Interactive Algorithm

- Individuals evaluated by the user
- Example: Emergent Mind
- Significant results in few generations
Objective Function

- Hideyuki Takagi sees two aspects:
- **Knowledge**: That which can be quantified
- **Kansei**: Intuition, subjectivity, preference
- Optimal solution exists in a psychological space

Source: Takagi, H. "Interactive Evolutionary Computation: Fusion of the Capabilities of EC Optimization and Human Evaluation" Fig. 2
Example: CG-Lighting

- IECs mainly used in art and design
- Hideyuki Takagi performed an experiment in CG-lighting
- The subjects consisted of professionals and amateurs
- The algorithm was of great help to amateur designers

Source: Takagi, H. "Interactive Evolutionary Computation: Fusion of the Capabilities of EC Optimization and Human Evaluation" Fig. 4
User Fatigue

- Evaluating large populations can be quite tedious
- Limits in display and human memory
- Usually limited to a maximum of 10-20 generations
- Smaller populations result in slower convergence
Predicting Values

- Calculate the euclidean distance in parameter space to predict fitness values
- Only display the most fit individuals to the user
- Allow the user to predict his own fitness values
Robot Choreography

- What constitutes a good dance is subjective
- SIEC algorithm to counter user fatigue
- Uses Neural Network to evaluate

Robot Choreography

- Degree of conformity 80%
- Dance evaluated by experts

Hearing Aid Fitting

- Fitted to individual characteristics
- Usually communicated to experts
- IEC allows patients to interactively fit

Source: H. Takagi and M. Ohsaki, “Interactive evolutionary computation-based hearing aid fitting,”
Hearing Aid Fitting

- Parameters decoded from 3D surface
- Surface shape is modified by GA
- Outperformed traditional methods
- However, very small sample size
- User fatigue was a problem

Source: H. Takagi and M. Ohsaki, “Interactive evolutionary computation-based hearing aid fitting,”
Questions

1. How would natural selection influence the future of mankind, considering that we spend most of our time on electronic devices?

2. Will the user-machine interaction ever become optimal or will it become obsolete?

3. What are everyday products that have to become personalized in the future? Why?