



Learning and Intelligent Optimization - LION 3

Trento, Italy – January 14-18, 2009

*Interactive Genetic Algorithm
for choosing suitable color in User Interface*

Luigi Troiano⁺, Cosimo Birtolo^{*} and Gennaro Cirillo^{*}

⁺ Engineering Department - University of Sannio, Benevento, Italy

^{*} Poste Italiane – Tecnologie dell'Informazione – Sviluppo Sistemi Informativi – Centro Ricerca e Sviluppo, Naples, Italy



→ Context

- ❑ According to UK Disability Rights Commission: “*Color accessibility is the second most recurrent accessibility barrier to the Web for disabled users*”
- ❑ Color Vision Deficiency (CVD) is known to be a significant barrier to effective computer use
- ❑ The importance of colors in an attractive and usable GUI
 - Attention management & Meaning of the colors

→ Problem

- ❑ Optimizing the colors in a GUI keeping into the account
 - ***Accessibility for Color Vision Deficiency Users***
 - ***Guidelines and Recommendation (W3C - WCAG 2.0)***
 - ***Explicit user’s preferences collected during designing phase***

→ Goal

- ❑ Design of an IGA able to improve color usage in an interface in order to satisfy
 - Contrast requirements
 - Chromatic choices of designers
 - User’s Feedback

Algorithm

➔ Algorithm: IGA

1. Evaluation
 - a) subjective component
 - b) objective component
2. Tournament Selection
3. Single Point Crossover
4. Bit switch Mutation

The algorithm was tested against two palettes

- Palettes made of 6 colors (132 bits)

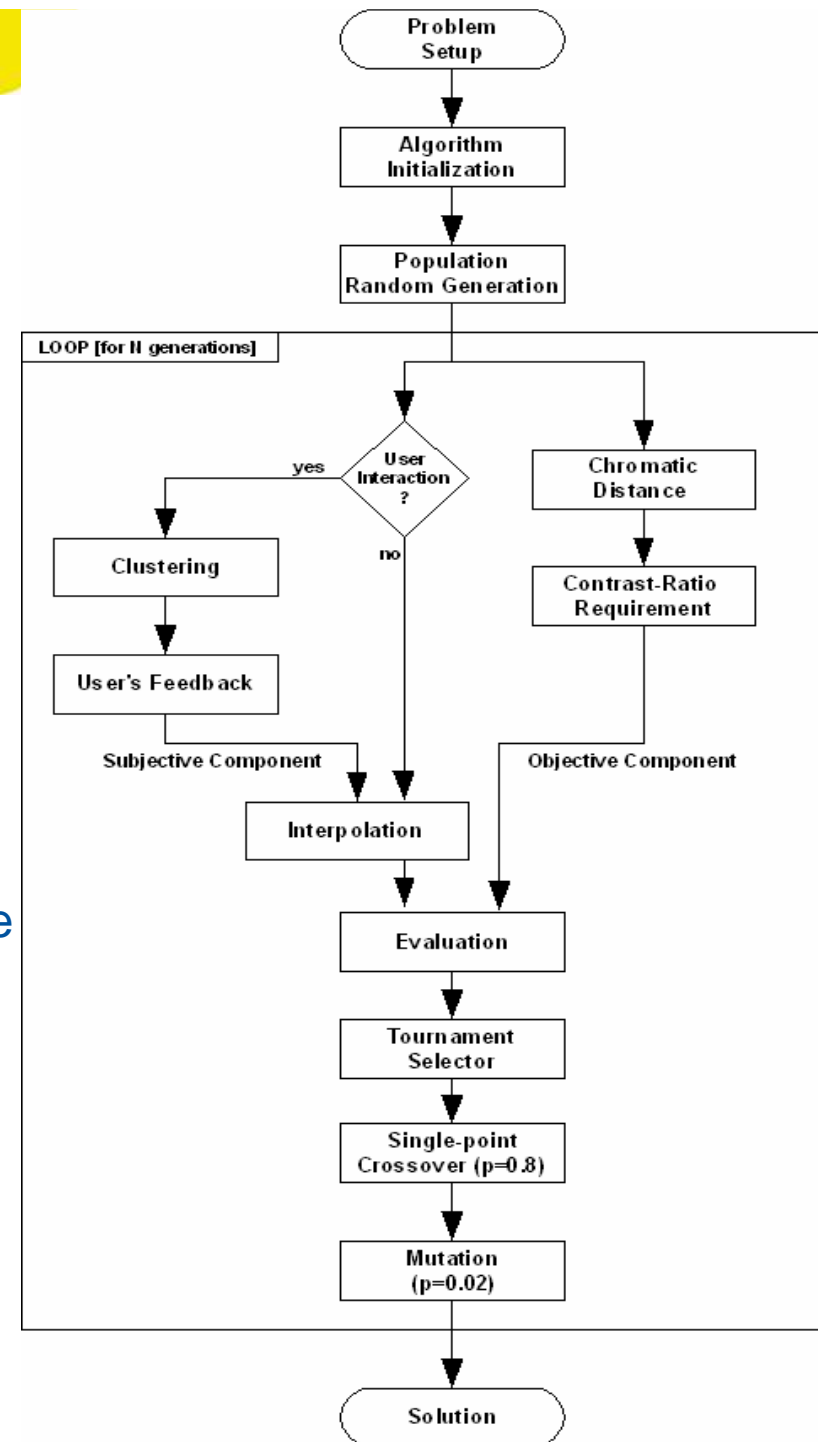


Number of colors commonly used in an interface

$$fitness = (objective^{w_1} \cdot subjective^{w_2})^{\frac{1}{w_1+w_2}}$$

$$objective = \left(\prod_{i=1}^n (1 - d_i) \prod_{j=1}^k c_j \right)^{\frac{1}{2 \cdot n + m}}$$

$$subjective = \left(\prod_{h=1}^n \left(\sum_{g=1}^k p_g \cdot s_g \right) \right)^{\frac{1}{2 \cdot n + m}}$$



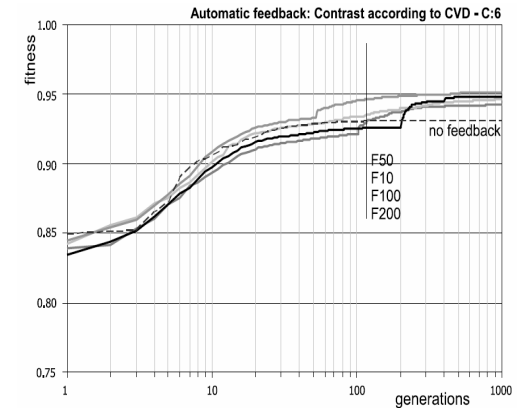
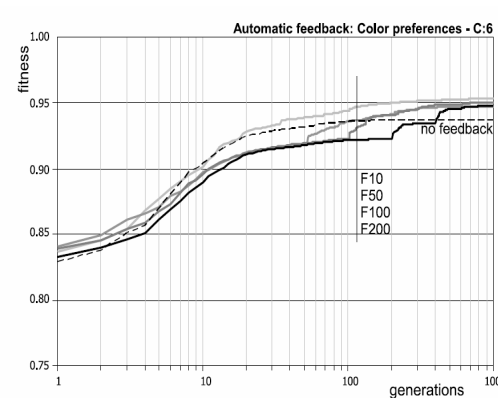
Example of application

→ Experimental Results

We define agents which simulates the human behavior by proving feedback according to some preference scheme.

The algorithm use 1000 generations on populations made of 500 individuals.

Charts refer to the average behavior of 10 different runs at different interaction rates



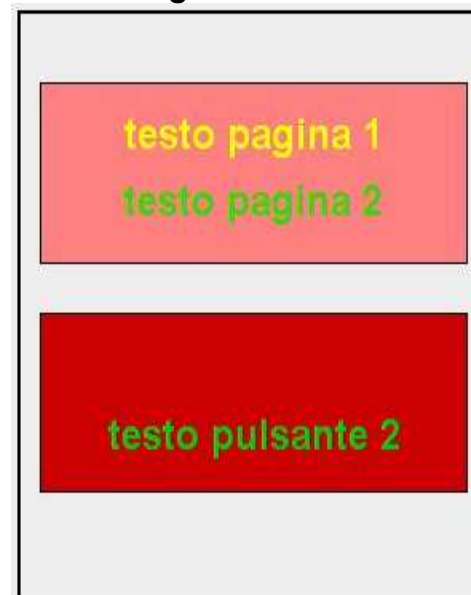
→ Problem Model:

- ❑ Original palette defined by GUI Designer
- ❑ User's Feedback
- ❑ Color relationship
- ❑ Constrast Ratio Required

→ Results: Optimization of the original palette

1. Improvement of Luminance Contrast between related colors
2. Preservation of the original chromatic settings
3. Capturing user intentions

Original Interface



Optimized Interface

