Generative UI design in SAPI Project

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Introduction

Usability and Accessibility engineering is generally addressed by providing documented recommendations and guidelines to content creators or interface designers, leaving the choice and the reaching of quality solutions entirely up to human ability. Existing guidelines, such as Apple’s Human Interface Guidelines and Sun’s Java Look and Feel Guidelines are either too specific or too vague, and do not therefore always apply to the problem at hand. UI designers tend to be guided both by objective measures gleaned from UI style guidelines and design principles, and by subjective measures such as the “look” and “feel” of an interface. However, reaching a trade-off between aesthetic considerations and other requirements, recommendations and guidelines is not an easy task to accomplish.

A menu layout is a hierarchical structure by which the user gains access to application functionalities. A menu layout is made of menus, each containing a list of items referring to submenus or to actions. Designers have to consider many aspects including:
- How effectively functionalities are retrieved and activated
- What standard guidelines suggest
- What are the preferences of users

These aspects are often conflicting and make menu system design a combinatorial optimization problem as it depends on the arrangement of each item in different positions onto the menu structure. We aim to investigate the application of both statistical and interventional models.

A Genetic Algorithm is implemented to identify best menu layouts and to select the menu organization which meets a set of preferences or constraints such as:
- Level Constraints
- Repetition Constraints
- Ordering Constraints (Path Ordering, Item Under Menu, Menu Ordering)
- Number Children Constraints

Example of Generative solutions for UI Design

Color Palettes

Color blindness, or Color Vision Deficiency (CVD), is known to be a significant barrier to effective computer use. According to UK Disability Rights Commission: Color accessibility is the second most recurrent accessibility barrier to the Web for disabled users.

Color vision impaired users perceive colors differently from normal users. This means, that although original colors could meet the required luminance contrast ratios for a normal user, the same colors, as perceived by visually impaired users, could not meet at all these requirements; perceived colors can show up with a lower contrast ratio, making difficult for same audience to access information and services. This requires to adopt colors that do not cause significant discomfort to users with CVD. This does not mean to renounce to the original chromatic idea and to make interfaces that are not attractive or boring. It is possible to look for a trade-off between chromatic choices and accessibility for impaired users. This requires to find among the possible color combinations, the palette providing high luminance contrast ratio, but still preserving the original chromatic choice.

As user-system interaction is the key focus, designing user interface attains to human creativity, perception and aesthetics. For color selection this aspect stands out. Choosing colors is part of the artistic process that leads to outline a user interface.

In SAPI this problem has been addressed by developing a Genetic Algorithm to identify the palette providing better contrast among different correlated colors and minimizing chromatic differences.

Optimization of the original palette for protanopes and deuteranopes. 1st column is the original palette, 2nd column is the perceived palette, 3rd and 4th columns are the optimized result seen by deuteranopes and by normal color viewers respectively.