GADGET: A Toolkit for Optimization-Based Approaches to Interface and Display Generation

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1 INTRODUCTION

Recent work is beginning to reveal the potential of numerical optimization as an approach to generating interfaces and displays. Optimization-based approaches can often allow a mix of independent goals and constraints to be blended in ways that are difficult to describe algorithmically. While optimization-based techniques appear to offer several potential advantages, further research in this area is hampered by the lack of appropriate tools. Optimization toolkits do exist, but they typically require substantial specialized knowledge because they have been designed for traditional optimization problems.

GADGET is an experimental toolkit to support optimization as an approach to interface and display generation. GADGET provides three core abstractions, *initializers*, *iterations*, and *evaluations*. An initializer creates an initial solution to be optimized, based on an existing algorithm or randomly. Iterations are responsible for transforming one potential solution into another, typically using methods that are at least partially random. Finally, evaluations are used for judging the different notions of goodness in a solution. Together with a evaluation standardization framework, support for generic properties integrated with an efficient lazy evaluation framework, and a library of reusable iterations and evaluations, the abstractions provided by GADGET simplify the development of optimization-based approaches to interface and display generation.

2 DISCUSSION

We are most interested in supporting hybrid approaches that take advantage of the strengths of both algorithms and optimizations. In general, these hybrid strategies should use algorithms to quickly perform the well understood portions of a problem, using optimization to solve the less understood portions of the problem.

For example, the dialog layout in Figure 1 was automatically generated using a hybrid approach based on the right/bottom strategy for automated dialog layout. The desired order, text, and size of the dialog components are taken from prior work by other researchers of automated dialog layout. In the right/bottom strategy, each component is placed either to the right of or below the previous component, according to a set of rules. An important difficulty with this strategy is developing an effective set of rules.

Our hybrid approach uses an implementation of the right/bottom strategy to handle the well understood parts of automated dialog layout, such as spacing and aligning components. The less well understood part of the problem, whether each component should be placed to the right of or below the previous component, is handled by an optimization. The initializer for this optimization simply places all of the components in a single long column. The iteration randomly toggles whether a random component is placed to the right of or below the previous component. Our evaluations then determine whether the resulting layout is an improvement.

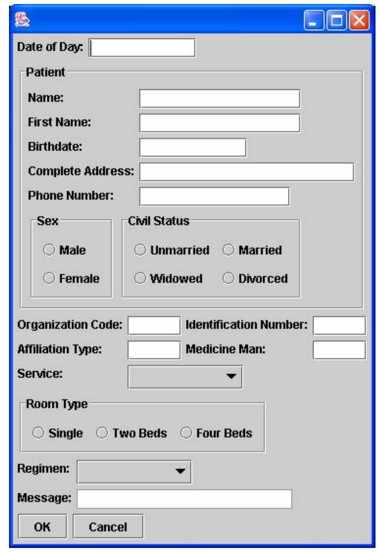

Figure 1: An automatically generated dialog layout.

This demonstration was implemented using four evaluations. The first tries to keep labels associated with a component (as indicated by a flag in the input specification) on the same row as that component. The second evaluation minimizes the size of the dialog and the size of each group box. A third evaluation minimizes the amount of unused space in the dialog and each group box. The final evaluation penalizes layouts in which a vertically large component appears to the right of a much smaller component, a situation previously identified as visually unpleasant. While additional evaluations could improve the robustness of the approach, these four evaluations are sufficient for automatically generating the dialog layout in Figure 1.

For a full discussion of GADGET as a tool for optimization-based approaches to interface and display generation, see [1].

REFERENCES

1. Fogarty, J. and Hudson, S.E. (2003). GADGET: A Toolkit for Optimization-Based Approaches to Interface and Display Generation. *Proceedings of the ACM Symposium on User Interface Software and Technology (UIST 2003)*, 125-134.