Optimization and Algorithms

Financial portfolio optimization

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***Abstract*—Para o problema de *Financial portfolio optimization*, dado um conjunto de *assets*, pretende-se obter uma forma de distribuir o dinheiro a investir por forma a maximizar o retorno. A cada *asset*, existe um risco associado, sendo que o risco de cada um poderá, ou não, influenciar o risco dos restantes. Se considerarmos todas as variáveis inerentes à otimização deste tipo de problemas, iremos obter funções não convexas, pelo que se considera uma aproximação facilmente computável através de otimização convexa e cujos resultados, obtidos a partir do *software CVX*, são bastante próximos dos ótimos. Posteriormente, o problema foi reformulado por forma a obter uma solução sub-ótima mas com menor tempo de computação.**

I. Introduction

Explain clearly the problem that you address. Use words only, i.e., avoid math (this will be given later).

Motivate the problem. At a high level, what is the problem area you are working in and why is it important? Then, zoom in to the specific problem considered in this paper.

Finally, summarize what are the main contributions of your paper given the context you have established in the previous paragraphs. What is the general approach taken? Why are the specific results significant?

For the paper outline you can write something like: “The remainder of the paper is organized as follows. In Section II, we introduce... Section III describes ... Numerical results of... are presented in Section IV. Finally, we state our conclusions in Section V.” Note that Section is capitalized.

II. Problem formulation

You now introduce the optimization problem to be solved. Explain the variables used. Mention which ones are optimization variables. Write the problem formulation *e.g.*, as

$$\begin{array}{ll} \text{minimize} & x^\top A x + b^\top x \\ \text{subject to} & Cx \leq d \\ & \|x - p\| \leq 1 \end{array} \tag{1}$$

noticing that the equations are part of the text flow, so they are also punctuated, when needed.

III. Approach

Here you describe what you have done to solve the problem stated in equation (1). Whenever you use a result or an algorithm from a book or a paper, or when you want to refer to some other work, don’t forget to cite it. In [1], you can find further information about bibliography.

In this document I have included one reference: the number in brackets in the previous paragraph. At the end of the document you can see the full reference.

IV. Numerical results

How does it really work in practice? Provide simulated performance metrics. If possible, compare with other well-known methods.

Explain your experiments’ setup to make it easily understandable and replicable by a reader from the field that does not know your problem.

Comment your results. It might help to show a plot, as to illustrate your commentary, like Figure 1.

The commentary of the plots should not just repeat the graphically obvious such as ”the solution is different from the original signal”, but explain, for example, how this difference relates to quick changes on the signal. Is the solution too slow to follow the signal variations? What is the magnitude of the error?

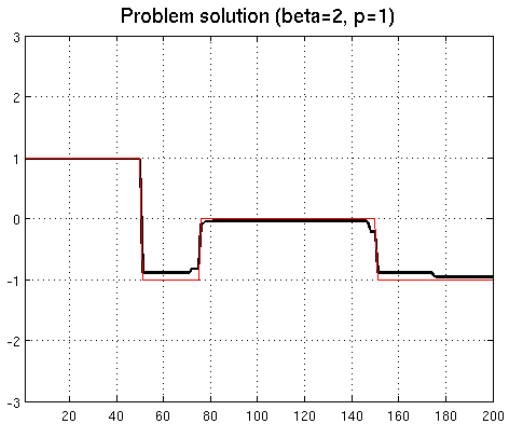

Fig. 1. Solution for the L1 norm cost function.

You might also want to vary the problem’s parameters and see how the solution evolves. Don’t forget to explain why is the choice of parameters in the solution depicted in Figure 1 better than the others.

Figures should be chosen wisely. You can never lay out the whole parameter space, so provide insight into which parameters are significant over what range and which ones are less important.

V. Conclusions

In general a short summarizing paragraph will be sufficient. It should not simply repeat material from the Abstract or Introduction. In some cases it's possible to now make the original claims more concrete, *e.g.*, by referring to quantitative results.

References

[1] Tobias Oetiker, *The (not so) short introduction to LaTeX*. available at `http://tobi.oetiker.ch/lshort/lshort.pdf` 2011