

Preface

This is the third book of a trilogy. As in the other books, a series of MATLAB programs are embedded in the chapters for several purposes: to illustrate the techniques, to provide implementation examples, to encourage for personal exploration departing from a successful start.

The book has two parts, each having just one chapter. These chapters are long and have a considerable number of bibliographic references.

When using a GPS on a car, sometimes it is not possible to keep contact with satellites, like for instance inside tunnels. In this case, a model of the car motion—a dynamic model—can be used for data substitution. The adequate combination of measurements and models is the key idea of the Kalman filter, which is the central topic of the first part of the book. This filter was formulated for linear conditions. There are modifications for nonlinear conditions, like the extended Kalman filter, or the unscented Kalman filter. A new idea is to use particle filters. These topics are covered in the chapter under an important perspective: Bayesian filtering.

Compressed sensing has emerged as a promising idea. One of the intended applications is networked devices or sensors, which are becoming a reality. This topic is considered in the second part of the book. Some experiments that demonstrate image denoising applications were included.

For easier reading of the book, the longer programs have been put in an appendix. And a second appendix on optimization has been added to support some contents of the last chapter.

The reader is invited to discover the profound interconnections and commonalities that exist behind the variety of topics in this book. This common ground would become surely the humus for the next signal processing future.

As said in the preface of the other books, our particular expertise on signal processing has two main roots: research and teaching. I belong to the Faculty of Physics, University Complutense of Madrid, Spain. During our experimental research on autonomous vehicles, maritime drones, satellite control, etc., we practiced main methods of digital signal processing, for the use of a variety of sensors and for prediction of vehicle motions. From years ago, I teach Signal Processing in a Master of Biomedical Physics, and a Master on New technologies.

The style of the programs included in the book is purposively simple enough. The reader is invited to typeset the programs included in the book, for it would help for catching coding details. Anyway, all programs are available from the book web page: www.dacya.ucm.es/giron/SPBook3/Programs.

A lot of different materials have been used to erect this book: articles, blogs, codes, experimentation. I tried to cite with adequate references all the pieces that have been useful. If someone has been forgotten, please contact me. Most of the references cited in the text are available from Internet. We have to express our gratitude to the public information available in this way.

Please, send feedback and suggestions for further improvement and support.

Acknowledgments

Thanks to my University, my colleagues and my students. Since this and the other book required a lot of time taken from nights, weekends and holidays, I have to sincerely express my gratitude to my family.

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3

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