SYSTEMS ANALYTICS: Data Science WORKBOOK
for Engineers

by ***PG Madhavan***
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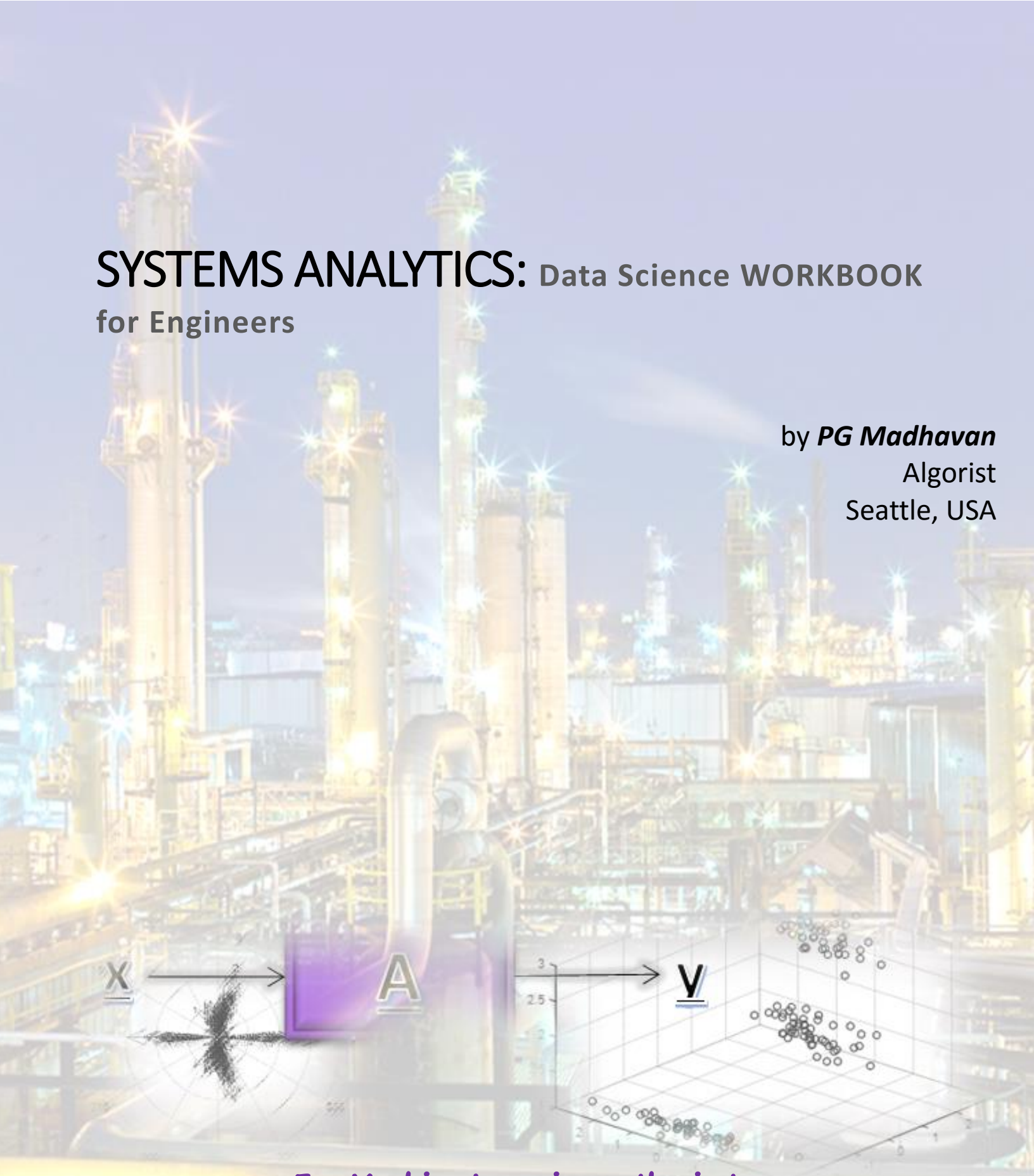

For Machine Learning enthusiasts
(with a STEM degree) everywhere!

About the author

PG Madhavan, Ph.D., has 20+ years of Data Analysis experience and developed his Analytics expertise as an EECS Professor, Computational Neuroscience researcher, Bell labs MTS & Microsoft Architect. He blogs regularly, has many publications & presentations to Sales, Marketing, Product and Research groups as well as 12 issued US patents. He has played key roles in four startups with two as Founder.

Preface

My intention is writing this book is to bring mathematically trained graduates in engineering, physics, mathematics and allied fields into Data Science. This book is neither an introductory read nor a theoretical treatise. It is a WORKBOOOK with MATLAB code that creates a common framework and points out various interconnections. This will allow you to link your past knowledge to Data Science (or Machine Learning or Analytics) as applied to business. As such, you may not see formal rigor at every step nor will you be able to solve your business problems right away. My hope is that the interconnections exposed will inspire you to develop many new algorithms that will turn out to be of "industrial strength".

I will be most grateful for corrections in the text that you send to pgmadbiz@gmail.com

PG Madhavan
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Part I Machine Learning from multiple perspectives

In this part, we bring together Machine Learning, Systems Theory, Linear Algebra and Digital Signal Processing. The intention is to make clear the similarity of basic theory and algorithm among these disparate fields. Hands-on exposure to Machine Learning is also provided. This part concludes with a complete derivation of Recurrent Neural Networks which has a sound mathematical basis for many important applications.

Part II Systems Analytics, the future evolution

With the realization that business solutions are not "one and done" and require ongoing measurement, tracking and fine-tuning, we embed Machine Learning in a closed-loop, real-time Systems framework. This naturally leads to the formal development of state-space formulation, Kalman filter, integration of Graph Theory and Analytics that allows social and influence networks to play its proper part in Analytics solutions and lastly, spatio-temporal dynamics and associated Random Field Theory that can faithfully model all the essential complexities of real-life business problems.

Intended Audience

This book is neither a hard-core text nor a popular science read. Engineers of all ilk are introduced to Data Science that leverage their engineering *science* background. Newly minted Data Scientists can see the larger framework beyond the bag-of-tricks they learned and glimpse the future of "dynamical" Machine Learning (which we call "SYSTEMS Analytics"). Use this workbook as a motivation and pathfinder on your travels from plain ML to Dynamical ML!

Contents

PART II - Systems Analytics, the future evolution