

Chapman & Hall/CRC  
Data Mining and Knowledge Discovery Series

# Machine Learning and Knowledge Discovery for Engineering Systems Health Management

Edited by  
**Ashok N. Srivastava**  
**Jiawei Han**



CRC Press  
Taylor & Francis Group

A CHAPMAN & HALL BOOK

# Table of Contents

List of Figures, xi

List of Tables, xxi

Machine Learning and Knowledge Discovery for Engineering  
Systems Health Management, xxiii

ASHOK N. SRIVASTAVA AND JIAWEI HAN

Editors, xxxiii

Contributors, xxxv

## SECTION I **Data-Driven Methods for Systems Health Management**

CHAPTER 1 ■ Mining Data Streams: Systems and Algorithms 3

---

CHARU C. AGGARWAL AND DEEPAK S. TURAGA

CHAPTER 2 ■ A Tutorial on Bayesian Networks for Systems  
Health Management 39

---

ARTHUR CHOI, LU ZHENG, ADNAN DARWICHE, AND OLE J. MENGSHOEL

CHAPTER 3 ■ Anomaly Detection in a Fleet of Systems 67

---

NIKUNJ OZA AND SANTANU DAS

CHAPTER 4 ■ Discriminative Topic Models 115

---

HANHUAI SHAN, AMRUDIN AGOVIC, AND ARINDAM BANERJEE

CHAPTER 5 ■ Prognostic Performance Metrics 147

---

KAI GOEBEL, ABHINAV SAXENA, SANKALITA SAHA, BHASKAR SAHA, AND  
JOSE CELAYA

SECTION II **Physics-Based Methods for Systems Health  
Management**

CHAPTER 6 ■ Gaussian Process Damage Prognosis under  
Random and Flight Profile Fatigue Loading 181

---

ADITI CHATTOPADHYAY AND SUBHASISH MOHANTY

CHAPTER 7 ■ Bayesian Analysis for Fatigue Damage  
Prognostics and Remaining Useful Life  
Prediction 203

---

XUEFEI GUAN AND YONGMING LIU

CHAPTER 8 ■ Physics-Based Methods of Failure Analysis and  
Diagnostics in Human Space Flight 245

---

VADIM N. SMELYANSKIY, DMITRY G. LUCHINSKY,  
VASYL V. HAFIYCHUK, VIATCHESLAV V. OSIPOV, IGOR KULIKOV, AND  
ANN PATTERSON-HINE

CHAPTER 9 ■ Model-Based Tools and Techniques for Real-  
Time System and Software Health Management 285

---

SHERIF ABDELWAHED, ABHISHEK DUBEY, GABOR KARSAI, AND  
NAGABHUSHAN MAHADEVAN

SECTION III **Applications**

CHAPTER 10 ■ Real-Time Identification of Performance  
Problems in Large Distributed Systems 339

---

MOISES GOLDSZMIDT, DAWN WOODARD, AND PETER BODIK

CHAPTER 11 ■ A Combined Model-Based and Data-Driven  
Prognostic Approach for Aircraft System Life  
Management 363

---

MARCOS ORCHARD, GEORGE VACHTSEVANOS, AND KAI GOEBEL

CHAPTER 12	▪ Hybrid Models for Engine Health Management	395
------------	--	-----

---

ALLAN J. VOLPONI AND RAVI RAJAMANI

CHAPTER 13	▪ Extracting Critical Information from Free Text Data for Systems Health Management	423
------------	---	-----

---

ANNE KAO, STEPHEN POTEET, AND DAVID AUGUSTINE

INDEX, 451