Contents

1 Introduction 1
   1.1 Complex Dynamics and Deterministic Chaos 2
   1.2 Spatial Complexity and Aperiodic Patterns 7
   1.3 Thesis Overview 10

2 Information–entropic analysis of chaotic time series 12
   2.1 Introduction 12
   2.2 The coarse-graining method 14
   2.3 Delay Determination 15
   2.4 Discussion 21

3 Symbol sequence analysis of climatic time signals 23
   3.1 Introduction 23
   3.2 Methodology 25
   3.3 Application & Results 26
   3.4 Discussion 39

4 Spatial complexity: DNA sequences 42
   4.1 Introduction 42
   4.2 Factorial moment analysis 43
   4.3 Block Information Entropy 50
   4.4 Correlation analysis of Matrix Attachment Regions on Human chromosome 22 51
      4.4.1 Methods and Results 52
   4.5 Correlations in DNA 57
5 Segmentation of Genomic DNA

5.1 Introduction .............................................. 60
5.2 Segmentation through Entropic Divergence .......... 62
  5.2.1 Application and Results .............................. 64
  5.2.2 Discussion ........................................... 70
5.3 Domain Reorganization: Decomposing complexity .... 72
  5.3.1 Segmentation using model selection ............... 74
  5.3.2 Insertion–deletion and heterogeneity ............. 74
  5.3.3 Patch relabeling .................................... 76
  5.3.4 Measuring the complexity ........................... 79
  5.3.5 A model of host–parasite interaction ............ 80
  5.3.6 Patch length distribution ........................... 82
  5.3.7 Discussion ........................................... 85

6 Thesis Summary ............................................. 86