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Chapter 1 : Read Download Mathematica By Example PDF â€“ PDF Download

Geographical Models with Mathematica provides a fairly comprehensive overview of the types of models necessary for the development of new geographical knowledge, including stochastic models, models for data analysis, for geostatistics, for networks, for dynamic systems, for cellular automata and for multi-agent systems, all discussed in their theoretical context.

Below is another set of recently published books using the Wolfram Language to explore computational thinking. From Curve Fitting to Machine Learning: An Illustrative Guide to Scientific Data Analysis and Computational Intelligence provides a great introduction to the increasingly necessary field of computational intelligence. This is an interactive and illustrative guide with all concepts and ideas outlined in a clear-cut manner, with graphically depicted plausibility arguments and a little elementary mathematics. Exploring topics such as two-dimensional curve fitting , multidimensional clustering and machine learning with neural networks or support vector machines, the subject-specific demonstrations are complemented with specific sections that address more fundamental questions like the relation between machine learning and human intelligence. Readers with programming skills may easily port or customize the provided code, so this book is particularly valuable to computer science students and scientific practitioners in industry and academia. The Art of Programming in the Mathematica Software, third edition Another gem for programmers and scientists who need to fine-tune and otherwise customize their Wolfram Language applications is the third edition of The Art of Programming in the Mathematica Software, by Victor Aladjev, Valery Boiko and Michael Shishakov. This text concentrates on procedural and functional programming. Experienced Wolfram Language programmers know the value of creating user tools. Scientists and data analysts can then conduct even the most sophisticated work efficiently using the Wolfram Language. Included is the MathToolBox package with more than tools; their freeware license is attached to the book. First exploring the numerous features within Mathematica, the book continues with more complex material. Chapters include topics such as sorting algorithms, functionsâ€"both planar and solidâ€"with many interesting examples and ordinary differential equations. The target audience for this text includes researchers, professors and studentsâ€"really anyone who needs a state-of-the art computational tool. This book gives a comprehensive overview of the types of models necessary for the development of new geographical knowledge, including stochastic models, models for data analysis, geostatistics, networks, dynamic systems, cellular automata and multi-agent systems, all discussed in their theoretical context. He also includes case studies to help the reader apply these programs in their own work. This book by Antonio Romano and Roberto Caveliere provides readers with the mathematical background needed to design many of the optical combinations that are used in astronomical telescopes and cameras. The results presented in the work were obtained through a different approach to third-order aberration theory as well as the extensive use of Mathematica. Replete with workout examples and exercises, Geometric Optics is an excellent reference for advanced graduate students, researchers and practitioners in applied mathematics, engineering, astronomy and astronomical optics. The work may be used as a supplementary textbook for graduate-level courses in astronomical optics, optical design, optical engineering, programming with Mathematica or geometric optics. It is available in print , as an ebook and free on the web â€"as well as in Wolfram Programming Lab in the Wolfram Open Cloud.

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Chapter 2 : New Books on Applications of the Wolfram Languageâ€"Wolfram Blog

Geographical Models with Mathematica provides a fairly comprehensive overview of the types of models necessary for the development of new geographical knowledge, including stochastic models, models for data analysis, for geostatistics, for networks, for dynamic systems, for cellular automata and for multi-agent systems, all discussed in their.

Scientific models are necessary to predict pandemics, terrorist attacks, natural disasters, market crashes, and other complex aspects of our world. By understanding where and how quickly the outbreak is likely to appear, policy makers can put into place effective measures to slow transmissions and ultimately bring the epidemic to a halt. Our goal here is to show how to set up a mathematical model that depicts a global spread of a pandemic, using real-world data. The model would apply to any pandemic, but we will sometimes mention and use current Ebola outbreak data to put the simulation into perspective. The results should not be taken as a realistic quantitative projection of current Ebola pandemic. To guide us through the computational science of pandemics, I have reached out to Dr. We have worked with him to code the global pandemic model below, a task made considerably easier by many of the new features recently added to the Wolfram Language. Marco is an applied mathematician with training in theoretical physics and dynamical systems. His research was featured on BBC News , and due to its applied mathematical nature, concerns very diverse subjects, from the stability of our solar system to patterns in the mating behavior of fireflies to forensic mathematics, and much more. Dealing with this diversity of real-world problems, Marco and his colleagues and students at the University of Aberdeen have made Wolfram technologies part of their daily lives. Its data summary as of October 27, , states that there are at least 18 Ebola patients who have been treated or are being treated in Europe and America, mostly health and aid workers who contracted the virus in West Africa and traveled to their home countries for treatment. There are no FDA-approved drugs or vaccines to defend against the virus, which is fatal in 60 to 90 percent of cases and spreads via contact with infected bodily fluids. The New York Times Vitaliy: Marco, do you think mathematical modeling can help stop pandemics? The recent outbreak of the Ebola virus disease EVD has shown how quickly diseases can spread in human populations. Therefore, mathematical modeling of the transmission pathways becomes ever more important. Health officials need to make decisions as to how to counter the threat. There are a large number of scientific publications on the subject, such as the recent Science publication by Dirk Brockmann , which is available here. Professor Brockmann also produced videos to illustrate the research, which can be found on YouTube video1 , video2 , video3. It would be interesting to reproduce some of the results from that paper and generally explore the subject with Mathematica. How does one set up a computational model of a spreading disease? Detailed online models, such as GLEAMviz , are available and can be run by everyone interested in the subject. That particular model contains, just like many other similar models, three main layers: I used a similar model that uses the powerful algorithms of Mathematica, its built-in databases, and its powerful data import capabilities. Some advantages of a DIY model are that we fully control the program and can amend it to our requirements. There are many different types of epidemic models. It models a population that consists of three compartments: To model the outbreak with the Wolfram Language, we need equations describing the number of people in each of these categories as functions of time. We will first use time-discrete equations. If we suppose first that there are only three categories and no interaction between them, we could get the following: This assumption means that people are taken out of the compartment of the susceptibles and go into the infected category. Next, we assume that people recover with a probability c; the recovery is proportional to the sick people; that is, the more who are sick, the more who recover. We also need initial values for the percentages of people in the respective categories. If we start at initial conditions that add up to one, the population size will always stay one. This is an important feature of the model. Every person has to stay in one of the three compartments; we will take great care to make sure that this is also true for the SIR model on the network that we describe later! There is, however, some flexibility of how we can interpret the three compartments. In our final example we will, for example, consider deaths. In order to keep our population constant, which is important for our model, we will then use a simple trick: It is a reasonable assumption that neither the dead nor the recovered infect other people, so they are inert to our model. Our simple assumption will be that a fixed percentage of people of the Rec group will be alive and the remainder will be dead. This results in a constant population size. This is a naive implementation of the SIR model, which allows you to change the parameters: We use vectors Sus, Inf, and Rec and iterate them. We will later develop a more direct implementation. For example, the infection rate b does describe the risk of infection and therefore models things like population density high density might lead to more infections and behavior of people if there are many mass events, that might increase the infection probabilityâ€"so does schooling! The recovery rate c might describe things like quality of the health care system, availability of physicians, and so on. Later we will try to model some of these effects more directly. The SIR model might not be the most suitable to describe an Ebola outbreak. It is, however, not too far off either. People get infected by contact; the Recovered category might be interpreted as holding the percentage of people who have either survived or died, if we assume that reinfection is unlikely. A more systematic way of looking at the overall behavior of the SIR model is to study the so-called parameter space. We can represent how different characteristics, like the highest number of infected or the total number of people who get infected in the course of the outbreak, depend on the parameters. The axes of the following diagram show the infection and recovery rates, and the percentage of people who contract the disease during the outbreak is color-coded: To go from pure mathematical to real-world simulations, we would need data, such as populations and their geographic locations. How could data be accessed? We will later couple different subpopulations e. Each subpopulation is described by an SIR model. When we start coupling the subpopulations, their individual sizes will play a crucial role. Population data, like many other types of data, is built right into Mathematica , so it is quite easy to use that for our modeling. We will use built-in data to improve our model toward the end, but for a start we could use the international network of all airports to model the transport of the disease. We first need a list of all airports and all flight connections. On the website openflights. We could use the latest Semantic Data Import feature to interface with external data. SemanticImport can import a file semantically to return a Dataset object. Dataset and Association are new functions and represent a structured database based on a hierarchy of lists and associations. Dataset can represent not only full rectangular multidimensional arrays of data, but also arbitrary tree structures, corresponding to data with arbitrary hierarchy. It is very easy to access and process data with Dataset, and we will make use of it. A tiny fraction of airports. All data files used here are attached at the end of this post, together with the Mathematica notebook. SemanticImport is very powerful. In my first modeling attempt I used Import and then the new Interpreter function, both of which are very powerful, too. But thanks to your suggestion to use SemanticImport, I could make the code much more concise and readable: Yellow-framed entries are semantically processed as Entity: So we notice that SemanticImport automatically classified the third and fourth columns as cities and countries and converted them to Entity, which is the built-in data representation in the Wolfram Language. We can now plot all airports worldwide. Indeed, with the new functionality GeoGraphics and its numerous options such as GeoBackground , GeoProjection , and GeoRange , we can tune up the image to a balanced representation of a massive amount of data: The fifth column in airports is a three-letter IATA airport code. We will need this airport identification code because it identifies connecting routes between airports in the second dataset. Not all data entries have it; for example, here are the last cases: Some of these are also false because they have numbers. We will clean the data by removing entries with no IATA valid code. Here are the original entries: We will retain cleaned-up rows in the total amount that follows: Next, we create a list of rules for all airport IDs and their coordinates: We used the Dispatch function, which generates an optimized dispatch table representation of a list of rules and will never affect results that are obtained, but may make the application of long lists of rules much faster. Now we can calculate the connections: Not every IATA code has geo coordinates. Out of a total of 67,, we will plot just 15, random routes, which reflects well on the full picture: Once we have the data, how can it be integrated with mathematical models? We need to describe the mobility pattern of the population. We will use the global air transport network to build a first model of a pandemic. We think of the flights as connections between different areas. We could make use of the Graph function to generate the network quickly and efficiently. There are many different routes between the same airports, and this would correspond to multigraph, a new

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Wolfram Language feature. For the sake of simplicity of a starting model, we will consider only the fact of connection between two airports, drawing a single edge if there is at least one route. We will use multigraphs later in the improved model: In the resulting graph, vertices are given by IATA codes. As we can see below, there are several disconnected components that are negligible due to relatively small size.

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Chapter 4 : Wolfram Demonstrations Project

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Chapter 5 : Modeling a Pandemic like Ebola with the Wolfram Languageâ€"Wolfram Blog

Geographical Models with Mathematica provides a fairly comprehensive overview of the types of models necessary for the development of new geographical knowledge, including stochastic models, models for data analysis, for geostatistics, for network.

Chapter 6 : Geographic Visualization: New in Mathematica 10

Summary. Geographical Models with Mathematica provides a fairly comprehensive overview of the types of models necessary for the development of new geographical knowledge, including stochastic models, models for data analysis, for geostatistics, for networks, for dynamic systems, for cellular automata and for multi-agent systems, all discussed in their theoretical context.

Chapter 7 : Geographical Models with Mathematica eBook: Andre Dauphine: blog.quintoapp.com: Kindle S

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Geographic Visualization. The Wolfram Language introduces GeoGraphics, an extension of its powerful graphical functionality to produce maps. GeoGraphics offers full automation and freedom to handle cartographic projections, choice of zoom (from the whole Earth down to meter scale), map styling (street maps, relief maps,), and much more.