CSE/ECE 848 Introduction to Evolutionary Computation

Module 1 - Lecture 3 - Part 1

Problem Solving and Search: Problem Solving

Wolfgang Banzhaf, CSE
John R. Koza Chair in Genetic Programming

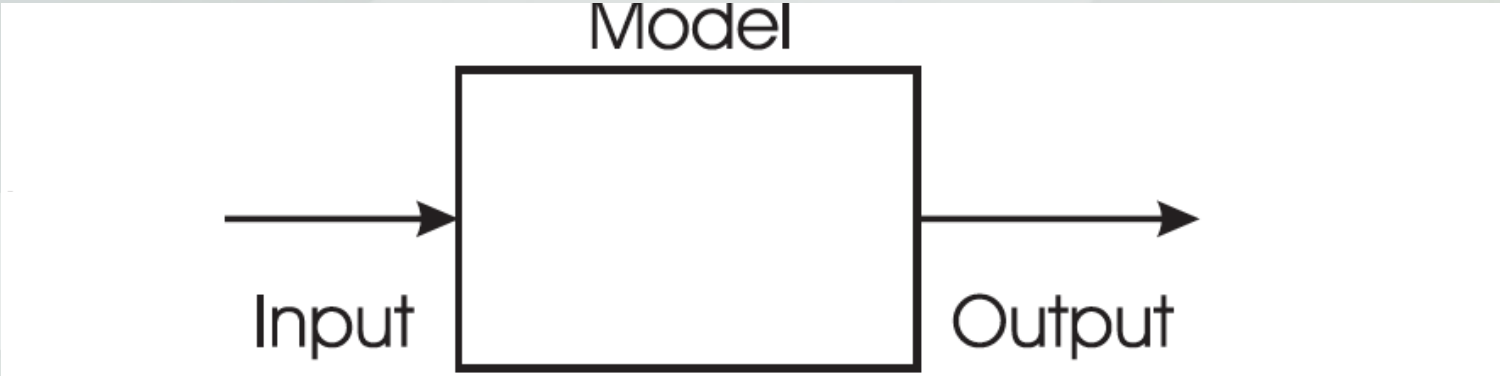
Problems

One can look at problems/problem solving from different perspectives:

- Modelling
- Searching
- Optimisation vs constraint satisfaction
- A particular class of problems: NP problems

Problem -> Model -> Solution

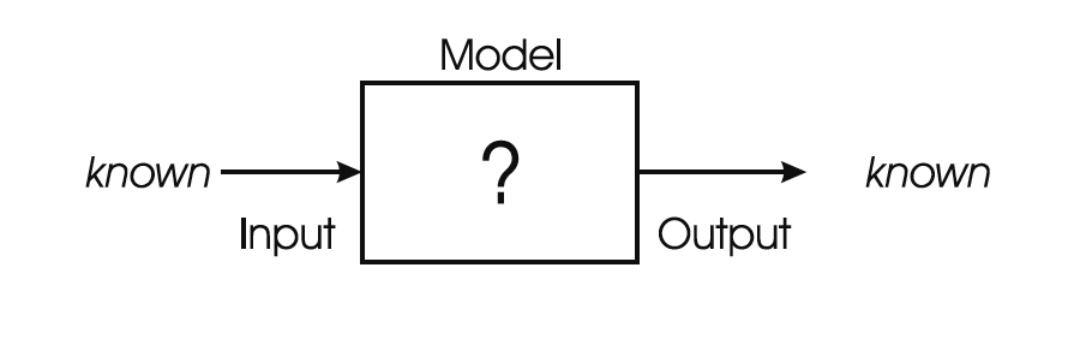
Models



- Consists of 3 components
- Different problems for different unknown component
- What is inside the box? Difference between black, gray, and white boxes

1. Creating a Model: Modelling or System Identification

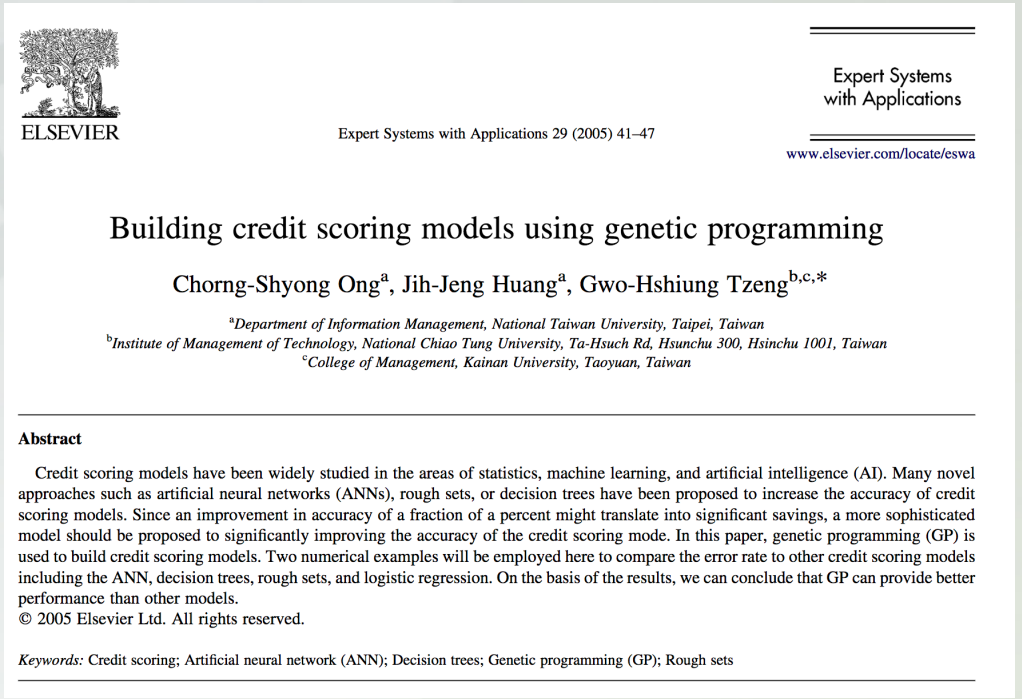
- Inputs and outputs are known, we search for the model that reproduces the desired outputs from the inputs



Examples:

- Classification of data with tagged examples
- Predicting stock exchange price development
- Voice-control system for smart home

Example: Credit Scoring



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Expert Systems with Applications 29 (2005) 41–47

Expert Systems with Applications

www.elsevier.com/locate/eswa

Building credit scoring models using genetic programming

Chorng-Shyong Ong[a], Jih-Jeng Huang[a], Gwo-Hshiung Tzeng[b,c,*]

[a]*Department of Information Management, National Taiwan University, Taipei, Taiwan*
[b]*Institute of Management of Technology, National Chiao Tung University, Ta-Hsuch Rd, Hsunchu 300, Hsinchu 1001, Taiwan*
[c]*College of Management, Kainan University, Taoyuan, Taiwan*

Abstract

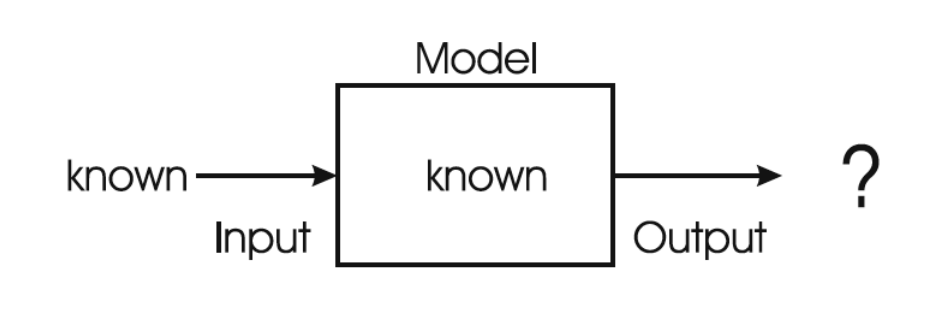
Credit scoring models have been widely studied in the areas of statistics, machine learning, and artificial intelligence (AI). Many novel approaches such as artificial neural networks (ANNs), rough sets, or decision trees have been proposed to increase the accuracy of credit scoring models. Since an improvement in accuracy of a fraction of a percent might translate into significant savings, a more sophisticated model should be proposed to significantly improving the accuracy of the credit scoring mode. In this paper, genetic programming (GP) is used to build credit scoring models. Two numerical examples will be employed here to compare the error rate to other credit scoring models including the ANN, decision trees, rough sets, and logistic regression. On the basis of the results, we can conclude that GP can provide better performance than other models.

Keywords: Credit scoring; Artificial neural network (ANN); Decision trees; Genetic programming (GP); Rough sets

- Input: Customer data
- Output: Score
- Model: Predict score from data

2. Using a Model: Simulation

- Model and inputs are known, we want to know what output is produced under different input conditions.

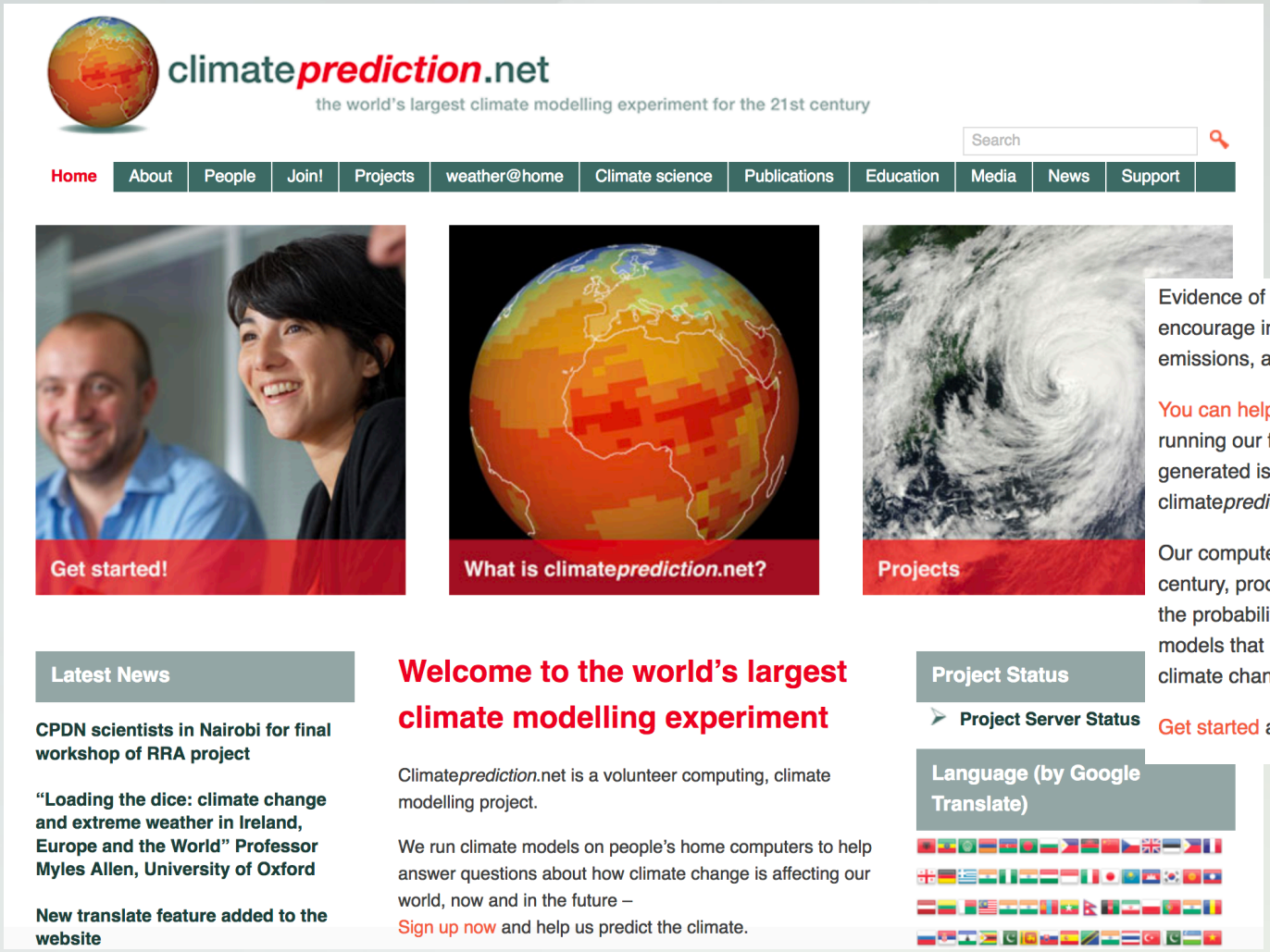


- What - if questions: Scenarios are tested in the dynamic environment provided by the model

Examples:

- Evolutionary economics
- Climate model
- Impact analysis of a new tax system

Example: Climate Simulation



Evidence of how our climate is changing is vital to encourage investment in reducing greenhouse gas emissions, as well as coping with inevitable change.

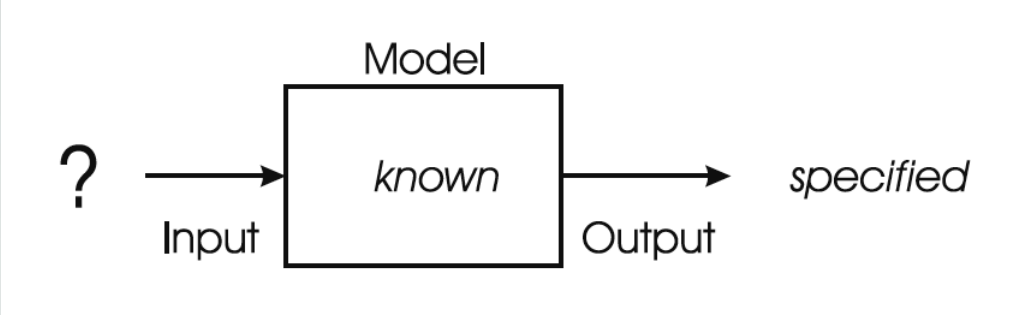
You can help discover how the climate could look by running our free software on your computer. The data generated is sent back to us and incorporated into the climate*prediction*.net projects.

Our computer models simulate the climate for the next century, producing predictions of temperature, rainfall and the probability of extreme weather events. The more models that are run, the more evidence we gather on climate change.

Get started and help us predict the climate.

3. Using a Model: Optimization

- Model and desired output are known, our task is to find inputs



Examples:

- Time tables for university, call center, or hospital
- Design specifications
- Traveling salesman problem (TSP)
- Eight-queens problem, etc.

Example: The 8 Queens Problem

- Given an 8-by-8 chessboard and 8 queens
- Place the 8 queens on the chessboard without any conflict
- Two queens conflict if they share same row, column or diagonal
- Can be extended to an n queens problem (n>8)