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Stochastic Dynamic Simulation Model Applied to Public Lawyers using Petri Nets

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Abstract

The aim of this article is to present a method of assignment of defence lawyers to causes, using tools Petri nets, decision trees and Monte Carlo method. It presents a simulation model of assignment applied to law activities, specifically to defender lawyers contracted by tender, using Petri Nets, Montecarlo and decision trees. The main difficulty of this assignment task is how to distribute equally the workload along the year between two kinds of lawyers: defender lawyers' staff and external (tendered) defender lawyer. The system utilized for analyzing task assignment is stochastic, parallel, concurrent and dynamic.

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Keywords: Petri Nets, Simulation Models, Decision Trees, Montecarlo, Defender Lawyers, Tender.

1. Introduction

The Public Defender Service Office is a state agency whose duty is to provide support to the defendants (accused) in criminal cases at their request, within a period not exceeding 90 days from the indictment. This is organized in Regional defender lawyers' offices (in each region), and each of them, in Local offices. Each Local Office assigns Defender Lawyers (Defence Lawyers) to different courtrooms within its jurisdiction courts, assignment that depends on the Local Chief defender Lawyer [1]. Generally, courtrooms assignments to Defender Lawyers depend on the number of cases they are dealing with and the projection of days that Local Chief Defender perceives that each Defender will take to solve the pending cases. Thus, in an instant during the year each defender has a set of cases that he is processing plus the cases that appear in the courtroom in which he is assigned that day, which can be solved the same day or can be passed to the set of pending lawsuits.

On the other hand, in order to fulfil its mission, Public Defender Service Office annually bids Public Defender Lawyer positions to private law firms, which contribute with a group of defender lawyers. These defender lawyers work in the Public Defender's office as long as the tender contract lasts. So, in a particular period of the year, the Public Defender Service Office has available hired lawyers ("Local Defenders") and

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those from tender agreement.

The terms of this tender agreement with these law firms set that they have to contribute with the workforce (Tendered Defenders Lawyers) to the Public Defender's Office according to a fixed number of yearly cases (which were 470 cases/yearly for each Defender Lawyer, reaching a total of 10 Tendered Defender Lawyers in the studied "comuna" (term equivalent to county).

The difficulty is that, for a particular time during year, historically between August and November, the number of cases agreed with these law firms in the tender contract expires, and all the remaining pending work, together with remaining work until year end, lies with Local Defender Lawyers. In the studied year (2006), the cases were assigned with a single national criterion based on the total number of cases that a Defender Lawyer can handle during one year.

On the other hand, the type of crime, the geographical characteristics of each region, the distribution of courts, the type of management associated to the type of crime, legal procedures, investigations, audiences, etc.., suggest that there is a dispersion in the effective time intended for similar cases, and especially when comparing between a simple case and a complex one. This phenomenon is beyond the simple randomness of stochastic processes and rather, is due to reasons that could be explained for the nature of the operations in each region, and the type of crime, and may even influence the Defender Lawyer's experience.

The problem modeled in this article is the allocation of cases to Defender Lawyers. The amount of accussed for each case is, for simplicity one. The comuna studied matches this condition (in 2006, 94.94% of cases had n accussed).

1.1. Montecarlo Generator

As a general rule, it's called Montecarlo any mathematical procedure in which random number generator is extensively used. The utility of this method, for a simulation model, is in the fact that, if there is no distribution for a specific event, you can compare a random number generated by a continuous distribution between zero and one, with a relative frequency of that event. If the generator is reliable, the probability of generation for each number in this range should be equiprobable [2].

The probability for the average absolute error to be less than 14.64% is 99.70%. In practice, what is done, bearing in mind the previous result is:

• To create a partition within the open interval (0, 1), so that the relative frequency of occurrence of a phenomenon corresponds bijectively to this section.

• To generate the appearance of a random number between zero and one, with uniform distribution. This assumes equal probability of appearance of any real number in this section, if the generator is reliable.

• To compare the generated number with the classes and locate its ownership. If it belongs to one of the given partitions, the feature associated with the class "fires".

• The fired property is entered to one of the components of the token that acts as a vector, and travels through the system.

• For another feature, the above steps are repeated, and so on.

1.2. Petri Nets

Petri nets allow the construction of several independent modules that produce a configuration that is determined from a combination of these modules, collaborating in this way to the modeling of the defense process [3]. Petri Networks are being used for modelling dynamic operations of discrete systems, mainly in manufacturing [4-5]. They are also utilized like a very useful tool for modelling, to analyse, to simulate and to control production systems [6]. Hierarchical and temporal Petri Nets also allow the construction of a simulation model with a knowledge based system built in, which is parametric, scalable and adaptable to various