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An Application of Artificial Neural Networks in Voir Dire Proceedings

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Introduction

In March 1992, police in Queens, New York, arrested a man in the act of raping a 61 year-old homeless woman. The grand jury wanted to know why she was outdoors at two in the morning. (Schafran, 1992)

Idealistically, a juror should consider only the facts; realistically, irrational stereotypes and preconceived opinions influence the outcomes of trials. It is fair to say that choosing the "right" juror can be critical to winning a case. Factors that affect jury decision-making may be inappropriate to our system of law. The juror's experience as a victim or witness to a crime, the race or gender of the defendant, media exposure, and many other factors can cloud judgment. Because they cannot be eliminated, however, it is to one's advantage to minimize factors that might produce an unfavorable outcome.

Oftentimes, a trial attorney can overlook the importance of choosing the right juror. There are means by which an attorney can minimize jury bias. There is a process in the American legal environment by which the court and attorneys preliminarily examine prospective jurors to determine their qualification and suitability to serve as jurors. This process is known as *Voir Dire* (vwar deer) and it translates as "to speak the truth." (Black's Law Dictionary, 1990) After all, an attorney wants the juror to be as honest as possible about opinions and feelings that he might have that could affect the outcome of the trial. As recourse, the trial attorney can make a *challenge for cause* or a *peremptory challenge*. A challenge for cause is a request from a party to a judge that a certain prospective juror not be allowed to be a member of the jury because of specified causes or reasons. A peremptory challenge is a request from a party that a judge not allow a certain prospective juror to be a member of the jury. No reason or "cause" need be stated for this type of challenge. The number of peremptory challenges afforded each party is normally set by statute or court rule.

For the most part, this process of challenging a juror's qualifications to sit on a jury is an intuitive process. Based on past experiences and similar situations, a trial attorney may intuitively "know" that this particular juror would not vote favorably on behalf of the lawyer's client. This intuitive process can be captured, in part, by an artificial neural network.

Artificial Neural Networks

An artificial neural network (ANN) is a type of system that emulates some abilities of the human brain. The human brain is made up of billions of cells called neurons, each neuron acting in effect as a tiny biological computer. By using relatively similar architecture as the brain, ANNs can simulate human abilities such as pattern recognition, finding hidden relationships in data, and learning by studying the past. ANNs use a highly interconnected group of "neurons" that process information in parallel. (Fu, 1994)

As an aid in *Voir Dire*, ANNs can play an important advisory role: predicting whether or not a potential juror will vote in favor or against a particular defendant based on past, similar scenarios. Failure to identify jury bias can conceivably contaminate the jury panel and lead to an unfavorable outcome.

Literature Review

A literature review of the domain reveals that there is a role for juror questionnaires in the *voir dire* process. Any data used for an ANN would ideally be obtained from the administration of a questionnaire. In her article, "Juror Questionnaires Can Supplement *Voir Dire*," Marjorie Fargo explains that the time required to examine jurors can be greatly curtailed by using questionnaires that are completed by jurors before *voir dire*. Not only would pre-screening enable judges to acknowledge that disclosures in open court about the ability to serve on a jury may be extremely embarrassing to the potential juror but pre-screening could also provide inputs for an ANN to identify possible jury bias. (Fargo, 1993) Fargo contends that every questionnaire should contain questions designed to elicit the following information: demographics, media exposure, special interests, legal experience, case-specific experiences, attitudes, and juror hardship. Because ANNs, ideally, would rely on input gathered from questionnaires, it is important for successful gathering of information that questionnaires be allowed in court. Fargo notes that most courts are receptive to using juror questionnaires and the interest is attributed to several factors. One is that questionnaires are an effective and equitable tool to facilitate the *voir dire* examination without overburdening the court. Another reason is that questionnaires are a method of inquiry that yield full and forthright responses while protecting juror privacy.

On a general level, Warner in "A Neural Network-Based Law Machine: Initial Steps" discusses the appropriateness of artificial neural networks in legal problem solving. He argues that lawyers use both analogy (pattern matching) and deduction, legal problem-solving is amenable to both neural networks and expert systems. (Warner, 1992) Although Warner gives generalized propositions with few specific, concrete examples, his article does illustrate that there is a place for ANNs in law.

Schafran writes about the importance of *voir dire* in rape trials and indicates that jurors were deeply influenced by stereotypes about appropriate roles and behavior for women, and that jurors frequently cited the complainant's reputation as the basis for the verdict. (Schafran, 1992) She continues to note that if the complainant knew the defendant, the jurors were extremely unwilling to convict. And if the complainant was black, no matter what the race of the rapist, she was met with particular skepticism. The jurors in the survey were apparently influenced by stereotypes about black women as more likely to consent to sex or less likely to be harmed by forced sex. Schafran poses the question: how did people with these attitudes get to sit on rape juries? She answers that there is obviously a failure of *voir dire*. It is this failure to spot jury bias which this ANN is designed to correct. Because this ANN is designed using criminal felony cases which include sexual assault, Schafran's article is all the more relevant.

A review of the literature on artificial neural networks reveals no practical application currently existing that uses an ANN to aid in the jury selection process. ANNs and their role in the American legal system are a relatively unexplored area of the social sciences. It also shows the potential of using questionnaires in the *voir dire* process of rape trials and how neural networks can serve this process.

Methodology

The ANN used in this project was designed using Brainmaker/Netmaker™, version 3.1 neural network building software. The development process of an ANN ranges from the initial collection of data to the implementation of an ANN in a real-life situation.

The scope of this project includes selected criminal felony cases that have gone to a jury trial in the Sangamon County courthouse in Sangamon County, Illinois within the time period of July 1993 through July 1995. The ANN was trained to discern any patterns that may exist among the collected data.

Data Collection

Data used in this project was collected from the 7th Illinois Circuit Court in Springfield, Illinois. The information resides partially in hard copy format and computerized database. Only the information directly used for this ANN was gathered and processed.

Computer operators at the Sangamon County Courthouse printed a list of criminal felony cases tried within the past two years. Twenty-one criminal felony cases that went to trial with a verdict were selected from this list. Criminal felony includes such cases as aggravated sexual assault, battery, etc. Once this list was obtained, each hard copy file of each selected trial was obtained from records. The trial citation as well as the verdict was recorded and then each juror's demographic information was extracted from the computerized database and matched up with the trial. Juror information was originally obtained from a pre-trial administered questionnaire that included all of the inputs used in this ANN plus questions regarding name, address, county residence, ages of juror's children, hearing, sight, health, and US citizenship which was then entered into a computerized database for jury list management. These questions serve primarily to determine if the juror is able to successfully complete jury duty and were not deemed necessary and effective inputs for this project.

Preparation of Training and Test Data

By default, Brainmaker separates 10% of the available facts for testing. 339 total facts were available for training and testing; 305 facts were set aside for training; 34 were set aside for testing. A general rule for the number of training facts is that they should equal the product of the number of hidden neurons and the inverse of the training tolerance. (Lawrence, 1994) Given this rule and the network's structure, at least 129 training facts should be set aside.

Defining a Neural Network Architecture

The number of input neurons is 28; the number of hidden neurons is 18; there is only one output neuron. This configuration results in 522 internal connections. A default, random constant of 5 was used to initially randomize all connection weights.

Selecting a Learning Algorithm

BrainMaker v. 3.1, the software used in this project, employs the back propagation learning algorithm. Back propagation is a supervised learning scheme by which a multi-layered feed forward network with continuously valued neurons is trained to become a pattern matching machine. According to Fu, it is the most well known and widely used learning algorithm. (Fu, 1994)

Preprocessing Input and Output Data

A total of 9 important input variables are identified to determine the output verdict decision. They are Prior Juror, Occupation, Employer, Birthdate, Marital Status, Education, Number of Children, Gender of Defendant, and Zip Code.

Start Training and Testing the Network

This ANN was instructed to test while training and stop when 65% of the training facts were correct. This optimizes the neural network because the network may test better before it is done training. Manipulation of training tolerance and the number of hidden neurons to the stated values resulted in the best testing network to date.

Results, Conclusions, And Future Directions

This ANN has not yet been implemented in an actual courtroom *voir dire* process. However, this ANN has shown that with limited inputs, it is able during testing to predict the outcome of a trial at least 65% of the time which is a significant result in this context.

No attempt to obtain comparable information on the success of jury consultants was made. A binary choice logit model (McFadden, 1974), where the dependent variable is a guilty (or not-guilty) decision, could be built and compared with the ANN's performance. This limited ANN, however, has demonstrated the potential for ANNs in the *voir dire* process. We have a plan to conduct actual courtroom tests this summer and hence improve the ANN's performance.

The authors experienced many problems while conducting this project. Some of them may be resolved in the near future as technology progresses and/or using improved questionnaires. Some of the problems that were encountered are described below:

Jury deliberation is dynamic and this ANN is not able to capture the dynamics of deliberation. The data used for this project consisted mainly of a jury of twelve with a known verdict. How each individual juror would have voted is not known since a unanimous verdict is required.

Some inputs that may be primary determinants of voting behavior are not included. Race, for example, is a factor that most likely plays a major role in determining a person's voting behavior. This omission would seem to severely affect an ANN's performance in an actual situation. Gender is another untracked piece of data that would appear to be crucial, particularly in sexual assault cases, in influencing voting behavior. Amount of media exposure, juror's prior experience as a victim or witness to a crime, and other factors are not addressed.

These limitations do not render the ANN ineffectual, by any means. If conscious of these limitations, one can still use the ANN to aid in the jury selection process and mitigate undesirable verdicts.

Acknowledgments

Note: Due to space limitations, a large number of tables for data preprocessing, all the details of the methodology used, and the list of references have been omitted. Please contact the authors for a full version of the paper.