

A perspective shift from Fuzzy logic to Neutrosophic Logic

Swati Aggarwal

<https://youtu.be/WryVUv5Bq98>

Date and Time: Available at YouTube from 22nd November 2015

Uncertainty suffuse our daily lives and spans the whole gamut from stock market index fluctuations to weather prediction; from car parking in crowded area to traffic control, almost every domain that we can think of imprecision or ambiguity is very much part of it. So to build computationally intelligent models for different real world events, numerous types of mathematical formulations of various logics were given by the researchers. Fuzzy logic is one of the dominant logic in the domain of Computational Intelligence that gives suitable representation of real-world data/information and enables reasoning that is approximate in nature. It is quite uncommon that the inputs captured by the fuzzy models are 100% complete and determinate. Humans can take intelligent decisions in such situations, though this knowledge is also difficult to express in precise terms, but an imprecise linguistic description of the manner of control can usually be articulated by the operator with relative ease. In contrast to this, fuzzy models require complete information. Incompleteness and indeterminacy in the data can arise from inherent non-linearity, time-varying nature of the process to be controlled, large unpredictable environmental disturbances, degrading sensors or other difficulties in obtaining precise and reliable measurements.

This concept is written with the aim of adding another dimension to the field of Computational Intelligence by discussing relatively a nascent logic: Neutrosophic Logic, proposed by Florentine Smarandache in 1999. Neutrosophic Logic was developed to represent mathematical model of uncertainty, vagueness, ambiguity, imprecision, incompleteness, inconsistency, redundancy and contradiction. Neutrosophic logic is an extended and general framework for measuring the truth, indeterminacy and falsehood-ness of the information that closely resembles human psychological behavior. It is effective in representing different attributes of information like inaccuracy, incompleteness and ambiguous, thus giving fair estimate about the reliability of information. This concept suggests extending the capabilities of fuzzy representation and reasoning system by introducing Neutrosophic representation of the data and Neutrosophic reasoning system.

Neutrosophic logic is a generalized logic that has the capability of encompassing other logics as its special instances. So there seems a possibility of potential conversion of logic specific systems to more generalized and indiscriminate logical systems that can exhibit different logical behaviors depending on the nature of the problem being solved; which is possible by integrating Neutrosophic logic in computationally intelligent models.

Considering the above stated facts, definitely Neutrosophic logic holds its chance to be experimented and utilized for real world executions and human psychology simulations. Neutrosophic logic can find application in the areas like web intelligence, medical informatics, bioinformatics, decision making, relational databases, image processing, pattern recognition, preference structures, expert systems and any such domain where the information is very commonly inconsistent, incomplete, uncertain and imprecise.

Computational Intelligence Creating Procedural Content for Games

Joseph Alexander Brown

<https://www.youtube.com/watch?v=CeRNIB7RAKQ>

Date and Time: Available at YouTube from 22nd November 2015

Procedural Content Generation (PCG) allows for parameter models of designs to create content with minimal user interventions, or to provide a human with an overview of possible designs. Techniques involving generative methods, search based algorithms, and evolution, give the designer control over large design spaces. These techniques are at the forefront in novel tools for game design and assets: expanding replay-ability, reducing costs and entry points for asset creation, and allowing for personalized play experiences. These methods have also found their way into other industries, such as, fashion, architecture, and industrial design.

This talk will give an overview on the current thinking on PCG using biologically inspired searches to develop levels and enemy placement. Dr. Brown will give an overview of current independent and AAA games, and how these techniques are being used and will be used in the near future. The webinar will make a demonstration of evolutionary programming in the development for levels in a Diablo like space. Most importantly, it will look at how we can evaluate the designs produced, and how expert knowledge from players can be taken into account in the evaluation of a design.

Mathematical Evolution of Human Behaviors

Osama Salah Eldin

<https://youtu.be/6nVtFxpDoVA>

Date and Time: Available at YouTube from 22nd November 2015

Human behavior modeling has been the focus of many researchers over the last years. It is spreading enormously over a wide variety of applications such as video games, social studies, marketing ... etc. Different techniques have been used to dress intelligent agents in a human-like behavior.

Most previous trials for modeling human behaviors targeted predicting the future actions that a person or a group of persons may take. This includes predicting the next steps of a video game player, estimating the movements of a pedestrian on a street, anticipating the future choices of a user based on his past choices ... etc. This webinar talks about the artificial imitation of actual human behaviors such as wisdom, rashness, carelessness ... etc. Once an intelligent agent (IA) imitates a certain human behavior, it can autonomously take the same actions that a human user, with the same behavior, is expected to take. That is, a wise IA is expected to behave like a wise person when encountering the same situation.

Behavior is defined as “The action or reaction of something under specified circumstances”. This means that for an intelligent agent to imitate a human behavior, it must take the same actions a human may take when encountering a certain situation. Thus, a human exemplar must exist. Imitating that exemplar follows one of two techniques: direct (supervised) and indirect (unsupervised) behavior imitation.

In direct behavior imitation, a controller is trained to output the same actions a human took when he faced the same situation. This means that the performance of the controller depends on the performance of the human exemplar. On the other hand, an indirect behavior imitation controller is allowed to generate actions freely, that is, unguided by a human exemplar. Afterward, the controller is evaluated by comparing its actions with those of the human exemplar. This freedom in generating actions gives the indirect techniques more generalization over the direct ones. The novelty of the method introduced in this webinar is that it gives the IA more freedom and more generalization even over the indirect techniques. It extends the freedom of the indirect techniques by allowing the IA to evaluate itself without any human exemplar. The IA is just provided with a fitness function and left in the environment. It examines the environment, evolves different human-like behaviors, and selects the fittest one of them for that environment.

The novel IA introduced in this webinar uses GA along with two optimization methods (CMA-ES and Nelder-Mead) to evolve human behaviors. This is accomplished by formulating the given problem into a mathematical objective function and using the aforementioned methods to suggest different solutions of that objective function. Every solution of the objective function can be interpreted as a human behavior.

The presented technique is tested on Robocode game. It is noticed that a Robocode agent that uses that technique is able to not only evolve human-like behaviors but also select the most appropriate one for every opponent.

Driver Assistant

Petr Hurtik

<https://www.youtube.com/watch?v=CdspdNZo3Qg>

Date and Time: Available at YouTube from 21st November 2015

We developed a driver assistant which is a software running on mobile phone devices and increasing safety during a car drive. The software monitors a road in front of a car in a real time. The software running on a mobile phone placed on the front shield of a car activates a color and sound alarm whenever the car leaves the road. Additionally, two further functionalities are added, in particular, the sequence of images is recorded in a loop (black-box) and accurate GPS speedometer.

The main core of the software is a line detection algorithm which detects lines painted on the road. The motivation was the standard Hough Transform for a line detection. The essential point of the Hough Transform is a transformation of the image to the dual space, e. g., of line orthogonal distance from the origin and the angle of the line slope. However, this approach demonstrated low robustness w.r.t. rather frequent disturbances from the "optimal line". For instance, a shadow shed on a white line caused it was not detected or moderate curve was not detected either. Indeed, in the first case, the algorithm did not see it white enough, in the second case, it was not found straight.

Therefore, we proposed to replace each image pixel intensity with a fuzzy number and thus, to obtain an image represented by a fuzzy function. This idea was motivated by the intended increase of the robustness. For the sake of computational costs, triangular fuzzy numbers were chosen to be applied in the fuzzification process. Then, the Hough Transform was modified in order to work over the proposed structure. The difference consists in the computation of the approximate gradient magnitude instead of the computation of gradient magnitude using standard operators. The intensity we search for (color of the searched line) is placed into an argument of fuzzy number of the fuzzified image in its each point and thus, its membership degree to the given fuzzy number is evaluated. This membership degree is taken into account only if exceeding a given threshold. Consequently, the whole task in the dual space is again performed using the membership degrees.

The proposed approach was experimentally verified confirming its advantage in terms of speed and robustness (reliability). Using the proposed algorithm for a line detection we built an Android mobile phone application for the analysis and tracking of the road. Its processing speed is approx 15FPS. Furthermore, some other se were also implemented, e.g., the above mentioned frames in-loop recording (black-box) and the GPS speedometer, or a sound and visual alarm for the significant warning in the case of departing a road.

Imprecision management in natural language generation systems through the use of fuzzy sets

Alejandro Ramos

<https://youtu.be/5jBZgDj1Blw>

Date and Time: Available at YouTube from 22nd November 2015

Natural language generation is a research field in AI which addresses the problem of producing texts automatically from different kinds of input and for different purposes, including dialogue systems, text summarization or report generation from numerical data. In fact, regarding the latter example, the data-to-text subfield has emerged in recent years as a very promising discipline in both research and commercial aspects. It is focused on the creation of systems able to generate comprehensible texts from raw numeric data, which would otherwise be unfeasible for humans to produce due to many reasons, such as enormous dataset sizes, lack of expert staff, or too much effort and time involved in their manual creation.

Although many real data-to-text systems have appeared in recent times, none of them manage the imprecision inherent to human concepts in natural language, which is something that fuzzy set theory addresses. In this context, our aim is to research the use of fuzzy techniques (such as fuzzy linguistic summarization) in data-to-text systems and, in general, to explore convergence points between the fuzzy logic and natural language generation fields. For this, we believe that a strong collaboration between researchers from both fields will prove essential in the long term.

The problem of including uncertainty management in natural language generation systems through fuzzy sets is an open research issue. The purpose of this exploration is to improve the performance of such systems in the task of determining which linguistic terms will be included in the output texts, including adjectives and temporal and/or spatial expressions. We have already taken one step in this direction with the creation of GALiWeather (<http://dx.doi.org/10.1109/TFUZZ.2014.2328011>), a data-to-text weather forecast application which uses fuzzy sets and fuzzy quantified statements to perform a description of the cloud coverage variable. GALiWeather is fully operative since May 2015 as a public service at Meteogalicia's (Galician -NW Spain- Official Meteorological Agency) Website [1] (<http://www.meteogalicia.es/web/prediccion/localidades/localidadesIndex.action>), and generates daily short-term forecasts in natural language for 315 municipalities in the Galician region (Spain), in both Spanish and Galician languages.

To explore the relationship between natural language generation and fuzzy set theory is an open challenge we will undertake in order to advance research in both fields. At the same time, this will also be reflected in coming real natural language generation applications, with GALiWeather being the first of its kind.

[1] Meteogalicia received 55 million visits in 2014, which is a measure of the social impact of the services it offers.

E-commerce data integration through nature-inspired algorithms

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<https://youtu.be/1WGsh3mFB1M>

Date and Time: Available at YouTube from 22nd November 2015

During the last years, e-commerce is emerging as a new idea of economy, where trade transactions can be performed by buyers and sellers even if they are separated by geographic boundaries and time differences. This new economy provides benefits to both companies and customers by allowing the first ones to easily expand their business, and, the latter to buy merchandises in a flexible and convenient way. In this new scenario, the typical trend is the development of so-called marketplaces rather than individual online shops. In detail, a marketplace is an electronic mall where buyers may meet proposals of several suppliers and select the best goods they need. The marketplaces are an interesting solution for e-commerce actors because they allow vendors to display their products in a great showcase and buyers to compare products before they purchase them.

In order to achieve its benefits, a marketplace must provide customers with a single access point to what is sold in it. In other words, a marketplace should have a common product e-catalog used by each vendor that takes part in it. However, the creation of a common e-catalog is neither always possible nor desirable. Indeed, each vendor owns a local e-catalog, in which goods are organized according to criteria that suit its internal business processes. Therefore, without considering that the translation is a very costly operation, vendors are hesitant to translate their e-catalogs in a common e-catalog that could be less expressive than theirs. In addition, the solution of a common e-catalog is not desirable in some scenarios such as distributed environments where the agreement on utilizing the same e-catalog could strongly limit the fundamental feature of flexibility. For these reasons, the usage of a common e-catalog is not the best solution, instead, marketplaces could solve the aforementioned data integration problem by providing means for aligning e-catalogs so as to strongly reduce efforts for vendors. Since, e-catalogs are typically modelled through ontologies, the process of aligning e-catalogs represents an instance of the more generic one named ontology alignment process.

In detail, an ontology alignment process consists in identifying a collection of similar entities existing between different ontologies so to lead them in a semantic reconciliation. In last years, because of the complex and time-consuming nature of this process, approximate methods have been used for computing a sub-optimal ontology alignment. From this point of view, nature-inspired optimization methods could represent an efficient approach to perform this process.

In this webinar, we present the state-of-the-art of the nature-inspired optimization methods applied to performing the ontology alignment process and we discuss on their benefits and drawbacks. The webinar is concluded by an analysis of the efforts still to be made to solve the data integration problem in e-commerce scenarios.