Two Tools for Prototyping Legal CBR

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When representing a body of case law it is invaluable to have a means of executing the representation to check and refine the representation. This is better done using generic tools, since the focus can then be on the representation itself, rather that on the software using it. In this paper we prototype a novel representation of cases as dimensions [1], using a standard spreadsheet (Excel) which gives a numeric analysis and the web service Carneades [3], which allows visualisation of the representation. The domain modelled was that of the famous wild animals property law cases together with *Popov v Hayashi*, introduced in [4]. Fuller details can be found in [2].

An analysis of the cases in terms of dimensions was offered in [1], to accommodate different degrees of presence of factors. The idea here is that factors represent sub-ranges of dimensions. As we move from extreme pro-plaintiff to extreme pro-defendant the plaintiff is less and less favoured by the dimension. At some point the defendant will start to be favoured.

As we approach issues, we may need to introduce thresholds, so that a binary decision, required in a legal case, can be made. Three thresholds are required for our cases: to determine how close the pursuit needs to be to give possession to the plaintiff; to determine whether the land belongs to the plaintiff in a way which gives possession of the animals; and a threshold for where the law should intervene. The thresholds are represented by setting appropriate flags.

Spreadsheet Implementation. The spreadsheet has four areas: a *data* area to hold the case vectors, a *flags* area for the thresholds, an *abstract factors* area, used to propagate the initial values, and an *issues* area to resolve the issues. The heart of the model is in the abstract factors area. Here each cell represents one or two arguments, justifying the content of the cell. This can be realised using an IF...THEN...ELSE formula. Finally we reach the issue area, which indicates the degree to which each party is favoured on that issue. It is up to the user to decide whether the plaintiff is sufficiently favoured. The spreadsheet provides a systematic way to rapidly prototype an implementation of a dimensional analysis. As such it makes an excellent environment for the exploration of the effects of different flags and refinement of the rule set. The spread sheet is downloadable from www.csc.liv.ac.uk/t̃bc/FTP/popovDimensions.xlsx.

The Carneades Argumentation System. The Carneades argumentation system provides an integrated set of software tools for argument (re)construction, evaluation, mapping and interchange. Carneades 4.1, the latest version, is available online at `http://carneades.fokus.fraunhofer.de` and provides a way to import structured argument graphs in a number of formats. Argument graphs

are evaluated and then visualized in argument maps. Various graphic formats for output of the argument maps are available. The software is open source, available for download at (https://github.com/carneades/carneades-4). Carneades is currently being expressly developed to support case-based reasoning, in the European EAGLE project, where the goal is to develop a system enabling clerks in public administrations throughout Europe to share arguments about the application of open-textured concepts, such as "undue hardship", in concrete cases (http://www.eagle-learning.eu/).

In the wild animals cases there is an issue as to whether the plaintiff has a better motive than the defendant (otherwise it can be seen as fair competition) and if so, whether the motive is of sufficient importance for the law to intervene. In the spreadsheet, motivations are assigned a number indicating a point on the respective dimensions. Who has the better motive then is just a matter of simple numeric comparison. Similarly the importance is established by comparing the winning number with a threshold indicating the extent to which the law is prepared to intervene. But this is rather a crude representation. Motives in fact have a number of different aspects. For example, a person may be motivated by gain, by doing good for society and may have good or bad intentions. In Carneades we are able to explore these nuances. By identifying the different aspects of the motivations, and using a cumulative argument scheme we can see which of the various aspects apply to the participants to determine who has the better motive. Graphs showing the effect of different motives and different threshold are shown in [2]. Variations in cases and standards can be readily and visually explored.

Concluding Remark. When exploring the modelling reasoning with legal cases, or constructing a domain analysis it is useful to be able to execute a corresponding implementation in order to see whether the behaviour is as desired and expected, and to explore refinements if this is not so. This requires the availability of tools which enable rapid prototypes to be produced without undue programming effort. Spreadsheets and Carneades are two such tools.

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