

# Creation of Logical Models for Conducting Forensic Linguistic Expertise

Elizaveta Kobets <sup>1,\*</sup>, Arsenii Tretiakov <sup>2</sup>, Natalia Gorlushkina <sup>1</sup>

<sup>1</sup> ITMO University, Saint-Petersburg, Russia

<sup>2</sup> Universidad Carlos III de Madrid, Spain

\*Email: [www.kobets@yandex.com](mailto:www.kobets@yandex.com)

## ABSTRACT

The work is devoted to defining and selecting the main criteria, parameters, and features to create logical models. This is necessary for the subsequent preparation of the object model and rules for the developer, which are implemented based on a logical model, for the subsequent creation of a software prototype, writing software code. The use of the class method in software development can help: disparate structure data from a large number of sources that developers usually have to work with (laws, by-laws, standards, GOST standards, methods, methodologies, other sources of information); build the logic of implementing the search for the necessary information, which will later be displayed in the object model. Usually, information is presented separately in natural language, and for its structured presentation, a significant block of work is required in advance.

**Keywords:** *Class method, Logical model, Object model, Decision support system, Social media, Linguistic expertise, Fake news, Text classification, Legal decision support system, Law*

## 1. INTRODUCTION

The existing discrepancies in the design of cases of court decisions prevent analysis and legal verification of counterparties, rapid adoption of legal decisions. The search for reliable and necessary textual information from open sources for its subsequent analysis on a given topic takes a lot of time due to a large amount of information and complexity in processing search results. The proposed method of classes, when developing an object model, in its new reading, can be applied in automated systems [1,2]: in the field of law (including legal decision support systems), in the field of education (including norm control), in the field of improving management and decision-making in organisational systems (including flexible project management methods).

A new reading of the class method represents a modernisation of its application: first, we should formalise the "structural elements" under the study and correlate them with "subelements" (**Table 1**); then, based on this set of data, it is necessary to rank them and recheck the previously identified relationships

concerning "structural elements"; further, the classes themselves are visualised graphically in a logical model, and a control check is carried out again in the previously identified relationships concerning "structural elements". After that, when preparing the object model, the values of class properties are set based on the "description base" (Table 1) in the logical model. As a result, reference values of the corresponding properties of classes are obtained to develop a decision support system model in a specific area (in this case, in the field of law). Collectively, the above amount of data forms the basis of the rules being developed for developers and subsequent writing of the program code [3]. The use of the class method is interrelated to increase the efficiency of automated systems and is a non-trivial task of modern scientists and researchers.

## 2. RESEARCH METHODOLOGY

Obtaining results in the practical application of the class method was possible due to the combined use of such related methods as observation, comparative, statistical and content analysis, formalisation, N-gram,

experiment. Also, during the implementation of the development project, such project management methods as the Eisenhower method, the Gantt method, flexible Scrum and Kanban management methods were used together.

### 3. RESEARCH RESULTS

Based on the practice of using the class method by the authors [3,4], in its new reading and different fields, it is possible to identify the following general steps to "forming an object model by the class method" in the form of an algorithm:

- 1) systematise the requirements for elements when building an object model,
- 2) check the compliance of the elements with the requirements,
- 3) classify the elements,
- 4) compare the received arrays to the standards,
- 5) formalise according to the requirements of notations in the form of object-oriented programming schemes.

Work progress. As part of the task of conducting a problem-classification analysis, classes of court cases were determined under the existing codes of the Russian Federation (the Civil Code of the Russian Federation [5], the Criminal Code of the Russian Federation [6], the Code of Administrative Offenses of the Russian Federation - the Administrative Code of the Russian Federation [7], etc.). Next, an array of all textual data was collected by year (2017-2020) [8] from open sources. Then, the analysis and classification of all decisions of cases under the Civil Code of the Russian Federation concerning legal entities by the method of classes are carried out:

- 1) The Supreme Court of the Russian Federation: "definition" and "decision",
- 2) The Arbitration Court of the Russian Federation: "decision" and "resolution".

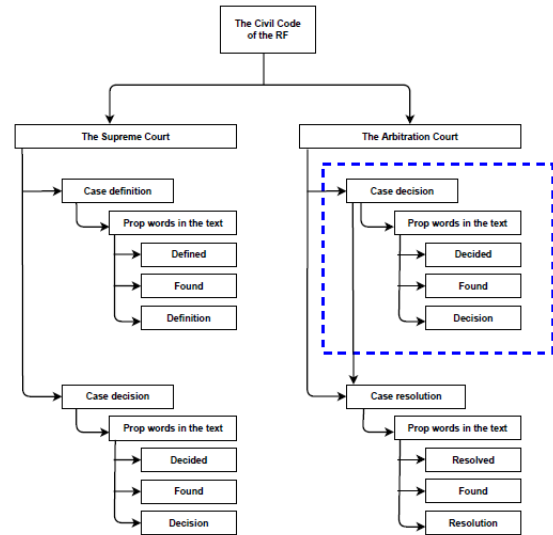
As a result of the first stage, a class of cases was selected - "decision" in the Arbitration Court of the Russian Federation, based on the document's structure determined by the method of classes (Figure 1).

According to only one source - the Arbitration Court of the Russian Federation - the number of cases from the list above amounted to 3036 cases. This volume of cases formed the basis for subsequent work with data and markup.

Then the following logical models were built:

- definitions of classes of structural elements of the document in the decisions of the Arbitration Court of the Russian Federation, based on Table 1,

- ambiguity of interpretations in the text of the decisions of the Arbitration Court of the Russian Federation,
- formalisation of requirements for the text of decisions of the Arbitration Court of the Russian Federation.



**Figure 1** "An example of a logical model of the Civil Code of the Russian Federation for determining classes of cases, blocks of document structure and document relationships".

When determining the structure of the document based on the collected decisions of the cases of the Arbitration Court of the Russian Federation, the method of classes revealed:

- 1) the basic elements of the structure of the document in the decisions of the Arbitration Court of the Russian Federation based on the analysis of the collected decisions of cases,
- 2) correlation of the "paragraph" element with the "quote" element in the internal structure of legal documents - in the design of decisions of the Arbitration Court of the Russian Federation, based on which the following list of eight "paragraph to quote" algorithms were built:
  - a) a paragraph in the form of text with no quotations - one sentence;
  - b) a paragraph in the form of text with no quotations - two or more sentences;
  - c) a paragraph in the form of a quotation text - one sentence;
  - d) a paragraph in the form of a text with one quote - one sentence;

**Table 1.** "Logical model for defining classes of structural elements"

Structural Element (SE)	Subelement (S)	Class	Features
SE 1	S 1.1	a1	Based on the description
	P 1.2	a2	
SE 2	S 2.1	b1	
	S 2.2	b2	
SE 3	S 3.1	c1	

e) a paragraph in the form of a text with two or more quotations - one sentence;

f) a paragraph in the form of a quotation - two or more sentences;

g) a paragraph in the form of a text with one quotation - two or more sentences;

h) a paragraph in the form of a text with two or more quotations - two or more sentences.

Also, thanks to this block of work with the use of the class method, a set of logical models that have found a final reflection are based on the algorithm described above for the "formation of an object model by the method of classes", logic was laid down to neutralise errors in the design of legal documents. Identifying common elements in the texts of decisions by the method of classes made it possible to fix the analysis results, visualise and build a logical model of elements (in the number of sixty elements) according to the decisions of cases Arbitration courts of the Russian Federation.

At the second stage, the above developments formed the basis for the construction and testing of a model for reading, extracting and processing information from the decisions of the Arbitration Court of the Russian Federation:

1) manual marking by the authors with the involvement of IT experts:

a) the main semantic blocks are highlighted;

b) identified patterns, similarities;

c) the evaluation of the criterion complexity of the document markup was carried out;

2) creating a list of elements that require correct design and setting parameters for them:

a) a unified block classification system has been created;

b) a logical model of the criteria evaluation of the document design has been created;

c) weights and capacities are set in the model, key relationships are created;

3) development of the specialised software to implement the program of the Government of the Russian Federation in the field of import substitution in the field of law and artificial intelligence is currently being carried out:

a) within the framework of experiments and test work, automated verification of the operability and stability of the model of the decision support system in the legal field;

b) big data validation;

c) fine adjustment of the weights in the models of the model of the decision support system in the legal field and their refinement;

d) as part of testing the work of neural networks, the analysis of the results is obtained in an automated way.

Thus, the following tasks are implemented:

1) a problem-classification analysis of classes of court cases was carried out,

2) the collection of court cases has been completed (the first stage is the manual collection of cases),

3) the structure of the document has been determined based on the collected decisions of the cases of the courts of the Russian Federation,

4) common elements in the texts of solutions by the method of classes are revealed,

5) models of reading, extracting and processing information from court cases have been built and tested (the second stage is automated).

The construction of such sets of logical and object models (Table 1, Figure 1) was also tested concerning the text of individual articles of the Civil Code of the Russian Federation at the experimental level to build a model of a decision support system in the legal field. In particular, the use of the class method within the framework of the structure of Article 152 of the Civil Code of the Russian Federation to build a logical model of linguistic expertise [9], to automate it, made it possible to identify the following list of the necessary information to create a legal decision support system:

- SE 1: the fact of dissemination of information by the defendant about the plaintiff,
  - S 1.1: temporary localisation;
- SE 2: defamatory nature of the information:
  - S 2.1: the presence of negative information:
    - S 2.1.1: information about the full name;
    - S 2.1.2: data on the name of the legal entity;
    - S 2.1.3: activity data:
      - S 2.1.3.1: Full name;
      - S 2.1.3.2: legal entity;
    - S 2.1.4: information about personal business and moral qualities of the full name;
    - S 2.1.5: what specific statements contain this information (quotes);
    - S 2.1.6: what is the semantic orientation of statements,
    - others.

#### 4. RESULTS DISCUSSION

Within the framework of the study of the field of law, particularly in the design of cases of court decisions, there are discrepancies, which prevents the subsequent data mining of unstructured legal information, especially in cases when mistakes are made in the preparation of such documents. To identify the main elements and the typical structure of a legal document, to detect errors in the design, to create a logical model for classification of common elements, it was necessary to conduct problem-classification analysis, using the method of classes in its new interpretation described above, defining classes of judicial decisions, cases, and collect examples of judicial decisions of Arbitration courts of the Russian Federation in open sources of information. The authors revealed that the following provisions should be distinguished in the field of law, which collectively describes the relevance of the field under consideration since there are:

1) discrepancies in the execution of cases of court decisions that hinder the analysis and legal verification of counterparties,

2) the search for reliable and necessary textual information from open sources for its subsequent analysis on a given topic takes a lot of time due to a large amount of information and complexity in processing search results.

It should be noted that the result of their own experience in Data Science and Data Analytics, the authors recommend the use of method application class, as reflected in Table 1, in the framework of the logical design of the structure to the fourth level, inclusive (SE1: S 1.1 + (S 1.1.1 + (S 1.1.1.1))) to avoid "redundant" and "insignificance" in the data structure during the subsequent design of the model (and model) that subsequently form the basis of the databases and develop together software interactions in software architecture.

#### 5. CONCLUSIONS

The proposed new interpretation of the class method is relevant in the framework of implementing the Digital Transformation Strategy [10] in the Russian Federation. Subsequent testing of the class method in other areas can help in creating an object model; thanks to this method, it is possible to organise work on creating automated systems capable of analysing and extracting information, including information from court cases on the example of decisions of Arbitration courts of the Russian Federation, despite the existing discrepancies in the design. The proposed method of classes can be used to create automated systems for legal verification of counterparties, legal decision support systems. By applying the method of classes, it is possible to expand the functionality of the object model, adapt and scale it to the decisions of other judicial instances. Thus, using the method of classes is possible and relevant for solving automation problems in the law.

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