Informational Model for Microfluidic System

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Abstract - **In this paper presented informational model for microfluidic system.**

Keywords – **informational model, model, microfluidic system, system, lab-chip, XML, DTD.**

I. INTRODUCTION

For the spectroscopic diagnosis and treatment of data classification information necessary to develop software that will contain all the information [1].

The process is characterized diagnostics data on laboratory-chip configuration, the radiation source, spectrometer and liquid, which explore. Lab-chip can be characterized by the following properties:

- The volume of liquid, which explore. These are important characteristics when in the presence of a minor amount of liquid.
- The geometry of the channel length, width, height and rounded channel.
- Material and manufacturing technology lab chip.

II. MODELS

The data model that describes a portable microfluidic device shown in fig.1.

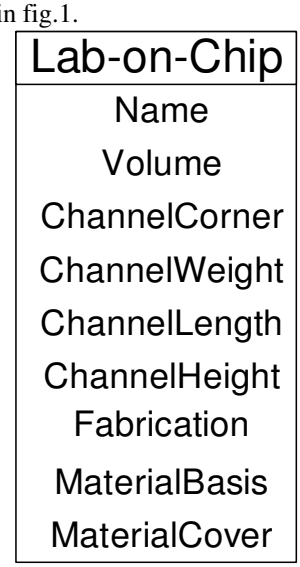

Fig.1. Lab-on-chip model

To describe the radiation source (fig 2), the following set of data:

- Type the radiation source (lamp, laser diode, etc.).
- The range of wavelengths. Each element has its own wavelength, which has the maximum intensity.
- The intensity with which the light is emitted.

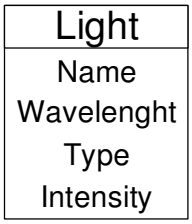

Fig. 2 Ration`s source model

The characteristics of the spectrometer interested in how much data it can get and where wavelengths gives the result. This characteristic is important because it is necessary to unify the data will arrive at the entrance to the neural network. The model contains additional data on the ratio of signal to noise, integrating and sensitivity.

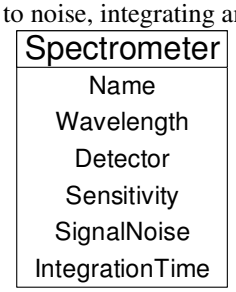

Fig. 3 Spectrometer`s data model

The data model contains a type of liquid fluid (organic, inorganic, microbiology, blend etc.), the composition of the fluid elements - fig.4.

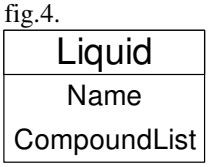

Fig.4 Liquid data model

The range is characterized by a set of appropriate wavelength intensity.

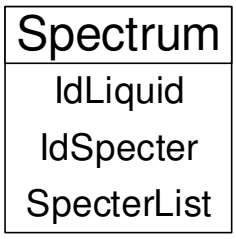

Fig. 5 Spectrum model

The process of classification is by using artificial neural network. Properties neural network below:

- Learning Algorithms and their number.
- The minimum weight of the neuron to be considered connected.

- The number of input and output neurons and the number of layers in a hidden level and the number of neurons in each of them.
- Balance in each of the neurons in the network.
- Additional features that characterize the type of neural network.
- List fluids, which operates neural network.

Thus, the model of a neural network configuration data – fig. 6.

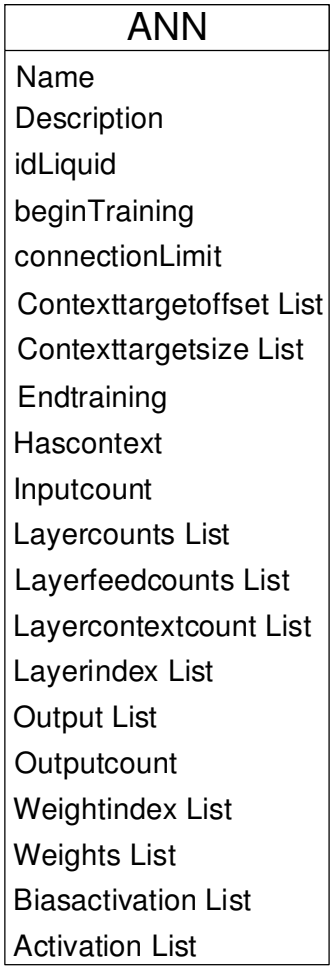

Fig. 6 Neural network model

Informational data model developed spectroscopic diagnostic process in Martin notation that binds all developed models – fig 7.

III. MODELS IN XML FORMAT

Given the prevalence of data in XML format appears just need to export data in this format [2]. Therefore it was decided to expand the format based on XML Schema [3] as a model description data. XML Schema replaced the DTD [4], since no typing DTD support spatial data and names.

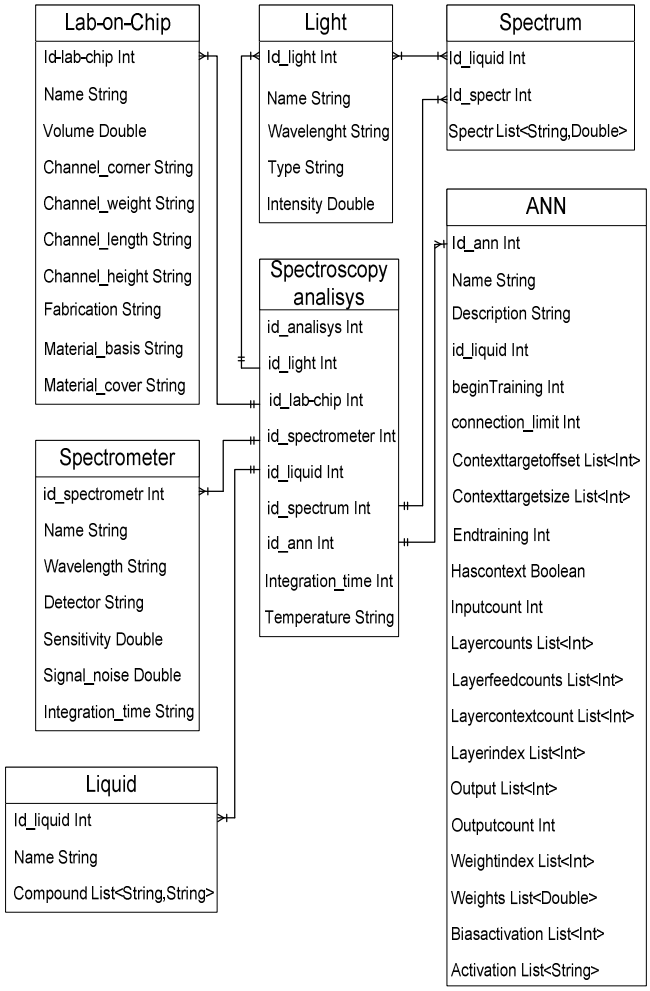

Fig. 7 Informational data model for spectroscopy analysis

As a result, the description using XML Schema data model lab chip will be as follows – fig.8.

```
<?xml version="1.0" encoding="utf-8"?>
<xs:schema
xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="labonchip"/>
  <xs:complexType name="labchip">
    <xs:sequence>
      <xs:element name="Name"
type="xs:string"/>
      <xs:element name="Volume"
type="xs:string"/>
      <xs:element name="Channel">
        <xs:complexType mixed="true">
          <xs:sequence>
            <xs:element name="cornerк"
type="xs:string"/>
            <xs:element name="Weight"
type="xs:double"/>
```

```
            <xs:element name="Height"
type="xs:double"/>
            <xs:element name="Length"
type="xs:double"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element name="Fabrication"
type="xs:string"/>
      <xs:element name="BasisMaterial"
type="xs:string"/>
             <xs:element name="CoverMaterial"
       type="xs:string"/>
    </xs:sequence>
  </xs:complexType>
 </xs:schema>
```

Fig. 8 XML Schema for Lab-on-chip model

The advantages of using XML [5]:

- Simplicity

Information coded in XML is easy to read and understand,

plus it can be processed easily by computers.

- Openness

XML is a W3C standard,

- Extensibility

There is no fixed set of tags. New tags can be created as they are needed.

- Self-description

XML documents can be stored without [schemas] because they contain meta data; any XML tag can possess an unlimited number of attributes such as author or version.

- Contains machine-readable context information

Tags, attributes and element structure provide context information ... opening up new possibilities for highly efficient search engines, intelligent data mining, agents, etc.

- Separates content from presentation

XML tags describe meaning not presentation. The look and feel of an XML document can be controlled by XSL stylesheets, allowing the look of a document (or of a complete Web site) to be changed without touching the content of the document. Multiple views or presentations of the same content are easily rendered.

- Supports multilingual documents and Unicode

This is important for the internationalization of applications.

- Facilitates the comparison and aggregation of data.

The tree structure of XML documents allows documents to be compared and aggregated efficiently element by element.

- Can embed multiple data types

XML documents can contain any possible data type — from multimedia data (image, sound, video) to active components (Java applets, ActiveX).

- Can embed existing data

Mapping existing data structures like file systems or relational databases to XML is simple....

- Provides a “one-server view” for distributed data

XML documents can consist of nested elements that are distributed over multiple remote servers. XML is currently the most sophisticated format for distributed data — the World Wide Web can be seen as one huge XML database.

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[2] David Hunter, Jeff Rafter, Joe Fawcett, Eric van der Vlist, Danny Ayers, Jon Duckett, Andrew Watt, Linda McKinnon, Beginning XML, John Wiley & Sons, 15 серп. 2011 - 1080p.

[3] XML Schema - http://www.w3.org/XML/Schema

[4] Document Type Definition - http://www.w3.org/TR/html4/sgml/dtd.html

[5] Benefits of XML (in general) - http://www.mulberrytech.com/papers/HowAndWhyXML/slide009.html

IV. CONCLUSION

In this paper showed informational model for spectroscopy analysis and presented XML Schema for this model.

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