Non IT configurable adaptive data mining solution used in transforming raw data to structured data

Bachelor's Thesis in Artificial Intelligence
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Contents

Abstract

1 Introduction

1.1 Introduction

Within the entertainment business there is no consistent style of informing people about the events. Different venues display their, often incomplete, information in entirely different ways. Because of this, converting raw information from venues to structured consistent data is a challenging and, relevant problem.

1.2 HyperLeap

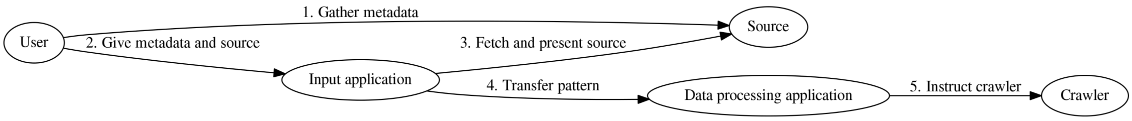
Hyperleap is a small company that is specialized in infotainment (information + entertainment) and administrates several websites which bundle information about entertainment in an ordered way and as complete as possible. Right now, most of the input data is added to the database by by hand which is very labor intensive. Therefore Hyperleap is looking for a smart solution to automate a part of the data injection in the database, the crux however is that the system must not be too complicated from the outside and be useable for a non IT professional(NIP).

1.3 Research question and practical goals

This brings up the main research question: *How can we make an adaptive, autonomous and programmable data mining program that can be set up by a NIP which is able to transform raw data into structured data.*

In practice the goal and aim of the project is to create an application that can, with NIP input, give computer parseable patterns which a separate crawler can periodically crawl. The NIP has to be able to enter the information about the data source in a user friendly interface which sends the information together with the data source to the data processing application. The dataprocessing application then in turn processes the data into a extraction pattern which is sent to the crawler. The crawler can visit sources specified by the NIP accompanied by the extraction pattern created by the dataprocessing application. This workflow is described in graph 1.1.

Figure 1.1: Workflow within the applications



In this way the NIP can train the crawler to periodically crawl different data sources without too much technical knowledge. The main goal of this project is to extract the underlying structure rather then to extract the substructures. The project is in principle a continuation of a past project done by Wouter Roelofs[**?**] which was also supervised by Franc Grootjen and Alessandro Paula, however it was neven taken out of the experimental phase. The techniques described by Roelofs et al. are more focussed on extracting data from substructures so it can be an addition to the current project.

As a very important sidenote, the crawler needs to notify the administrators if a source has become problematic to crawl, in this way the NIP can very easily retrain the application to fit the latest structural patterns.

1.4 Scientific relevance

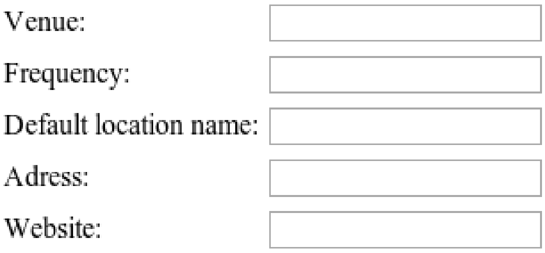
Currently the techniques for conversion from non structured data to structured data are static and mainly only usable by IT specialists. There is a great need of data mining in non structured data because the data within companies and on the internet is piling up and are usually left to catch dust.

2 Methods

2.1 Input application

The user input all goes through the familiar interface of the user's preferred web browser. By visiting the crawler's train website the user can specify the metadata of the source it wants to be periodically crawled through simple web forms as seen in figure 2.1

Figure 2.1: Webforms for source metadata



Venue:

Frequency:

Default location name:

Adress:

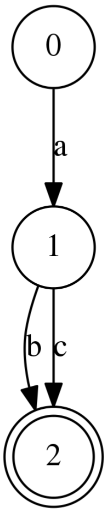
Website:

2.2 Data processing application

2.2.1 Directed acyclic graphs and finiti automata

Directed acyclic graphs(DAG) and finite state automaton(FSA) have a lot in common concerning pattern recognition and information extraction. By feeding words into an algorithm a DAG can be generated so that it matches certain patters present in the given words. Figure 2.2 for example shows a FSA that matches on the words *ab* and *ac*.

Figure 2.2: Example DAG/FSA

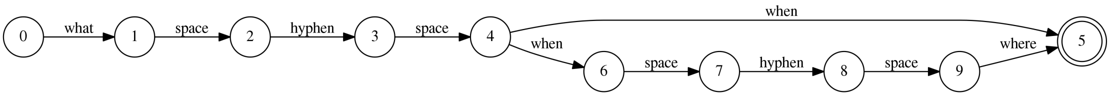


With this FSA we can test if a word fits to the constraints it the FSA describes. And with a little adaptation we can extract dynamic information from semi-structured data.

2.2.2 Back to DAG's and FSA's

Nodes in this data structure can be single letters but also bigger constructions. The example in Figure 2.3 describes different separator pattern for event data with its three component: what, when, where. In this example the nodes with the labels *what, when, where* can also be complete subgrahps. In this way data on a larger level can be using the NIP markings and data within the categories can be processed autonomously.

Figure 2.3: Example event data



2.2.3 Algorithm

2.3 Crawler application

3 Results

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4 Discussion

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5 Appendices

5.1 Input application

Python front/back-end

```
#!/bin/env python
# −*− coding: utf−8 −*−

from mod_python import apache, util
import feedparser
import re
import urllib
import subprocess
import os

def req_pre_pos(req):
    req. log_error (’handler’)
    req.content_type = ’text/html’
    req.send_http_header()
    args = util.FieldStorage(req)
    req.write(”””\
<html>
␣␣␣␣<head>
␣␣␣␣␣␣␣␣<title>VER:␣0.01␣−␣HyperFrontend␣RSS␣feed␣POSTREQUEST</title>
␣␣␣␣</head>
␣␣␣␣<body>
␣␣␣␣␣␣␣␣Thanks␣submitting:␣<br␣/>
␣␣␣␣␣␣␣␣<a␣href=”index.html”>Enter␣new␣rss␣feed</a>
␣␣␣␣␣␣␣␣<pre>
{}
␣␣␣␣␣␣␣␣</pre>
␣␣␣␣</body>
</html>
”””.format(args))
    os.chdir(’/var/www/py/files’)
    with open(’raw_out.txt’, ’w’) as f:
        f.write(str(args))


def req_pre(req):
    req. log_error (’handler’)
    req.content_type = ’text/html’
    req.send_http_header()
    req.write(”””\
<html>
␣␣␣␣<head>
␣␣␣␣␣␣␣␣<title>HyperFrontend␣RSS␣feed␣input</title>
␣␣␣␣␣␣␣␣<script␣src=”contextmenu_o.js”></script>
␣␣␣␣</head>
␣␣␣␣<body>

␣␣␣␣<table>
```

```
        <tr><td>Venue: </td><td>
            <input type="text" name="venue" class="indat"></td></tr>
        <tr><td>Frequency: </td><td>
            <input type="text" name="freq" class="indat"></td></tr>
        <tr><td>Default location name: </td><td>
            <input type="text" name="dloc" class="indat"></td></tr>
        <tr><td>Adress: </td><td>
            <input type="text" name="adress" class="indat"></td></tr>
        <tr><td>Website: </td><td>
            <input type="text" name="website" class="indat"></td></tr>
    </table>

    Selecteer iets en klik de link<br />
    <button style="color:blue" onclick="javascript:f_waar()">Waar</button>
    <button style="color:green" onclick="javascript:f_wat()">Wat</button>
    <button style="color:red" onclick="javascript:f_wanneer()">Wanneer</button>
    <br />

<div style="position:absolute; left:12px;width:500px;"></div>
<script language="javascript" type="text/javascript">
    var content='<b>Categorize</b><br />';
    content+=' <a href="#" onclick="javascript:f_waar()">Waar</a><br />';
    content+=' <a href="#" onclick="javascript:f_wat()">Wat</a>';
    content+=' <a href="#" onclick="javascript:f_wanneer()>Wanneer</a><br />';
    content+=' Test 123';
    init(content,120);
</script>
""")


def req_post(req):
    req.write("""\
            <button onclick="javascript:post_all()" method="post" target="_bla\
nk">Submit</button>
    </body>
</html>
""")


def feed2html(req, url, name):
    url = urllib.unquote(url)
    url = url if re.match('https?://', url) else 'http://{}'.format(url)
    req.write(
        '\tLoading "{}" as <p id="rssname">"{}"</p><br />\n'.format(url, name))
    feed = feedparser.parse(url)
    channel = feed.feed
    req.write('\t<table id="content-table" border="1" id="htab">\n')
    req.write('\t\t<tr><th>Title</th><th>Summary</th></tr>\n')
    for i in feed.entries:
        req.write('\t\t<tr><td>{}</td><td>{}</td></tr>\n'.
                  format(i['title'].encode('ascii', 'xmlcharrefreplace'),
                         i['summary'].encode('ascii', 'xmlcharrefreplace')))
    req.write('\t</table>\n<br />')


def handler(req):
    if req.method == "POST":
        req_pre_pos(req)
    else:
        req_pre(req)
        args = util.FieldStorage(req)
        if 'url' not in args and 'name' not in args:
            req.write('Something_went_wrong,_empty_fields?<br_/>')
            req.write('<a_href="index.html">back</a>')
        else:
            feed2html(req, args['url'], args['name'])
        req_post(req)
    return apache.OK
```

HTML landing page

```
<html>
    <head>
    </head>
    <body>
        <form method="get" action="./hyper.py">
            <table>
                <tr><td><p>RSS URL: </td><td><input type="text" name="url"
                        value="localhost/py/paradiso.rss.xml"></td></tr>
                <tr><td>RSS Name: </td><td><input type="text" name="name"></td></tr>
                <tr><td><input type="submit" value="Submit"</p>
            </table>
        </form>
    </body>
</html>
```

Javascript frontend

```
var selection;
var mouse_x = 0;
var mouse_y = 0;
var mouse_left = false;
var mouse_right = false;
if (document.addEventListener != undefined) document.addEventListener('mousemove', mouseMove, true);
else if (document.layers) document.captureEvents(Event.MOUSEDOWN | Event.MOUSEMOVE | Event.MOUSEUP);
document.onmousemove = mouseMove;
document.oncontextmenu = RightMouseDown;
document.onmousedown = mouseDown;
document.onmouseup = mouseUp;

function mouseMove(a) {
    mouse_x = document.all ? event.clientX + document.body.scrollLeft : document.layers ? a.x + window.pageXOffset : a.clientX + window.pageXOffset;
    mouse_y = document.all ? event.clientY + document.body.scrollTop : document.layers ? a.y + window.pageYOffset : a.clientY + window.pageYOffset
}

function RightMouseDown() {
    mouse_right = true;
    return false
}

function init(a, w) {
  console.log(a)
    var b = document.createElement("DIV");
    b.id = "contextmenu";
    if (!w) var w = 120;
    b.style.width = w + "px";
    var c = '<div_style="position:relative;left:5px;top:-4px;">';
    c += a;
    c += '</div>';
    b.innerHTML = c;
    b.style.position = "absolute";
    b.style.left = "0px";
    b.style.top = "0px";
    b.style.visibility = "hidden";
    b.style.overflow = "hidden";
    b.style.padding = "4px";
    b.style.backgroundColor = "#ffffff";
    b.style.border = "1px solid #6a6868";
    document.body.appendChild(b);
    delete b
}

function mouseUp(e) {
    var curselection = window.getSelection().getRangeAt(0);
    if (curselection.endOffset - curselection.startOffset > 0)
  selection = curselection;
    console.log(selection)
    if (e.which == 1) document.getElementById("contextmenu").style.visibility = "hidden";
    else if (e.which == 3) mouse_right = false
}

function mouseDown(e) {
    if (e.which == 3) {
        mouse_right = true;
        document.getElementById("contextmenu").style.left = mouse_x + "px";
        document.getElementById("contextmenu").style.top = mouse_y + "px";
        document.getElementById("contextmenu").style.visibility = "visible"
    }
}


function stylizeHighlightedString(range, col)
{
    var selectionContents = range.extractContents();
    var span = document.createElement("span");
    span.appendChild(selectionContents);
    span.setAttribute("class","uiWebviewHighlight");
    span.style.backgroundColor = col;
    span.style.color = "white";
    range.insertNode(span);
}

function f_wanneer() {
    stylizeHighlightedString(selection, "red")
}

function f_wat() {
    stylizeHighlightedString(selection, "green")
}

function f_waar() {
    stylizeHighlightedString(selection, "blue")
}

function post_all() {
    var xmlhttp = new XMLHttpRequest();
    xmlhttp.onreadystatechange=function()
    {
        if (xmlhttp.readyState==4)
        {
            document.write(xmlhttp.responseText);
        }
    }
    var params = ”content=”+encodeURIComponent(document.getElementById(”content−table”).innerHTML);
    params += ”&name=”+encodeURIComponent(document.getElementById(”rssname”).innerHTML);
    var indatarray = document.getElementsByClassName(’indat’)
    for (var i = 0; i<indatarray.length; i++) {
        params += ”&” + indatarray[i].name + ”=” + indatarray[i].value;
    }
    xmlhttp.open(”POST”, ”hyper.py”, true);
    xmlhttp.setRequestHeader(”Content−type”, ”application/x−www−form−urlencoded”);
    xmlhttp.setRequestHeader(”Content−length”, params.length);
    xmlhttp.send(params);
}
```