Retrieving Information in Croatian: building a simple and efficient rule-based stemmer

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INFuture2007

8 November 2007

Introduction

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  2. construct a simple and efficient stemmer which could be easily used in the industry

Existing stemmers for Croatian

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- Google started stemming Croatian documents in last few months, method unknown, most probably language independent - general rules + user feedback while using the search engine

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- 80% would upgrade their search engine with an open source of commercial stemmer, 10% would prefer an open source solution, 5% a commercial one, 5% are not interested

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- list of 32 suffix rules built by hand from the 1000 most frequent nouns

List of rules 1

```
('', 'a', 'u', 'om', 'i', 'ima', 'e')
('a', 'e', 'i', 'u', 'om', 'ama')
('e', 'a', 'u', 'em', 'ima')
('o', 'a', 'u', 'om', 'ima')
('', 'a', 'u', 'om', 'ovi', 'ova', 'ovima', 'ove')
('ak', 'ka', 'ku', 'kom', 'ci', 'aka', 'cima', 'ke')
('k', 'ka', 'ku', 'kom', 'ci', 'cima', 'ke')
('ac', 'ca', 'cu', 'cem', 'ci', 'aca', 'cima', 'ce')
('anj', 'nja', 'nju', 'njem', 'njom', 'nji', 'anja', 'njima', 'nje')
('ka', 'ke', 'ci', 'ki', 'ku', 'kom', 'aka', 'kama')
('ar', 'ra', 'ru', 'rom', 'ri', 'ara', 'rima', 're')
('ao', 'la', 'lom', 'lu', 'lovi', 'lova', 'lovima', 'love')
('', 'a', 'u', 'om', 'em', 'evi', 'eva', 'evima', 'eve')
('an', 'na', 'nu', 'nom', 'ni', 'ana', 'nima', 'ne')
('in', 'ina', 'inu', 'inom', 'i', 'a', 'ima', 'e')
('am', 'ma', 'mu', 'mom', 'movi', 'mova', 'movima', 'move')
```

List of rules 2

```
('t', 'ta', 'tu', 'tom', 'ti', 'ata', 'tima', 'te')
('zak', 'ska', 'sku', 'skom', 'sci', 'zaka', 'scima', 'ske')
('tak', 'tka', 'tku', 'tkom', 'tci', 'ci', 'taka', 'tcima', 'cima', 'tke')
('dac', 'ca', 'cu', 'cem', 'ci', 'daca', 'cima', 'ce')
('ga', 'ge', 'zi', 'gi', 'gu', 'gom', 'gama')
('st', 'sti', 'šću', 'stima')
('g', 'ga', 'gu', 'gom', 'zi', 'zima', 'ge')
('sao', 'sli', 'šlju', 'slima')
('t', 'ti', 'ću', 'tima')
('an', 'ni', 'nog', 'noga', 'nome', 'nomu', 'nim', 'ni', 'nih', 'nima', 'ne')
('o', 'og', 'oga', 'om', 'ome', 'omu', 'im', 'a', 'ih', 'ima', 'e')
('ni', 'an', 'nog', 'noga', 'nome', 'nomu', 'nim', 'ni', 'nih', 'nima', 'ne')
('a', 'e', 'oj', 'u', 'om', 'ih', 'ima')
('', 'i', 'og', 'oga', 'om', 'ome', 'omu', 'im', 'ih', 'ima', 'e')
('i', 'og', 'oga', 'om', 'ome', 'omu', 'im', 'ih', 'ima', 'e')
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  5. there is no set of rules, but just a set of suffixes without any entry restrictions ('', 'a', 'u', 'om', 'i', 'ima', 'e', 'ama', 'em', ...), , *zamka*, *rastom* and *radia* accepted

Optimization and evaluation

- using validation set - searching for set of suffixes which maximizes the F_1 measure regarding the gold standard - greedy optimization algorithm (*steepest ascent hill climbing*) - experimenting with different rule forms

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rule form	F_1	precision	recall	# of rules
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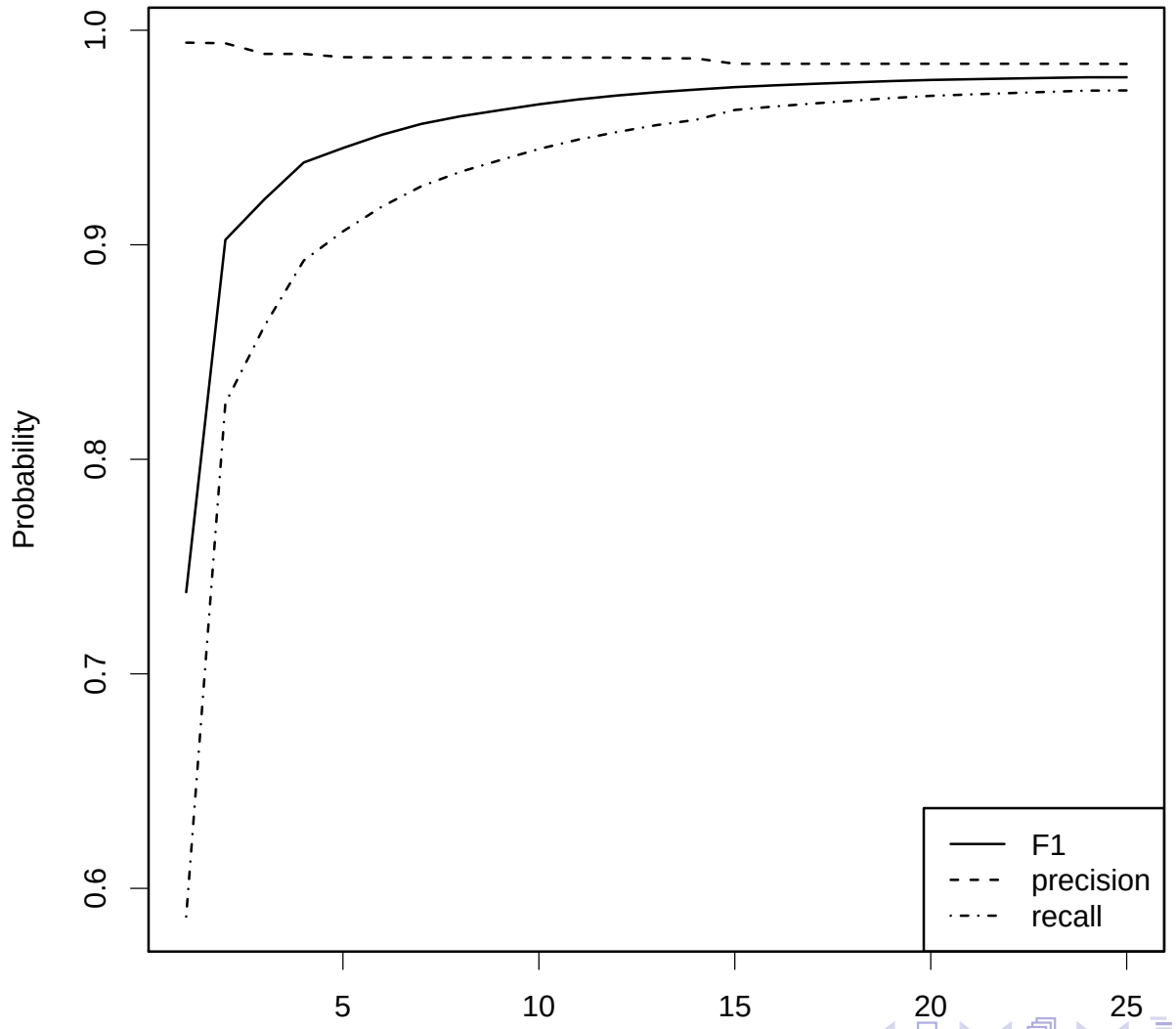
- on test set, second form of rules acieves F_1 measure of 97,82%, precision 98,40%, recall 97,24%

F_1, precision and recall during *steepest ascent hill climbing* optimization algorithm with second rule form



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- decline in F_1 of just $0,18$ - adjective and noun paradigms very simmilar

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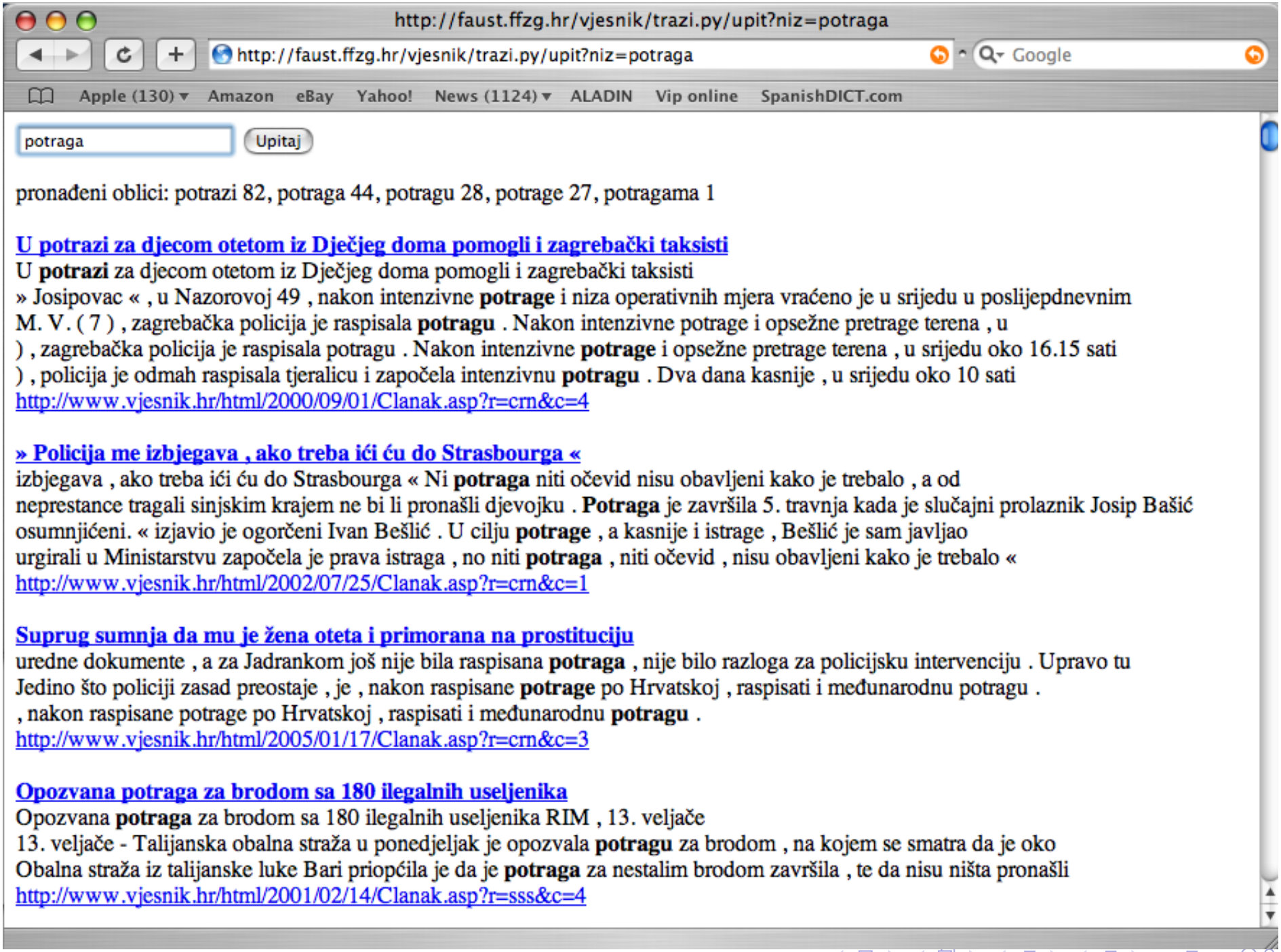
- an example web application for retrieving information from Vjesnik on-line using the web service


http://faust.ffzg.hr/vjesnik/trazi.py/upit?niz=potraga
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Google
Apple (130)
Amazon
eBay
Yahoo!
News (1124)
ALADIN
Vip online
SpanishDICT.com
potraga
Upitaj
pronađeni oblici: potrazi 82, potraga 44, potragu 28, potrage 27, potragama 1
U potrazi za djecom otetom iz Dječjeg doma pomogli i zagrebački taksisti
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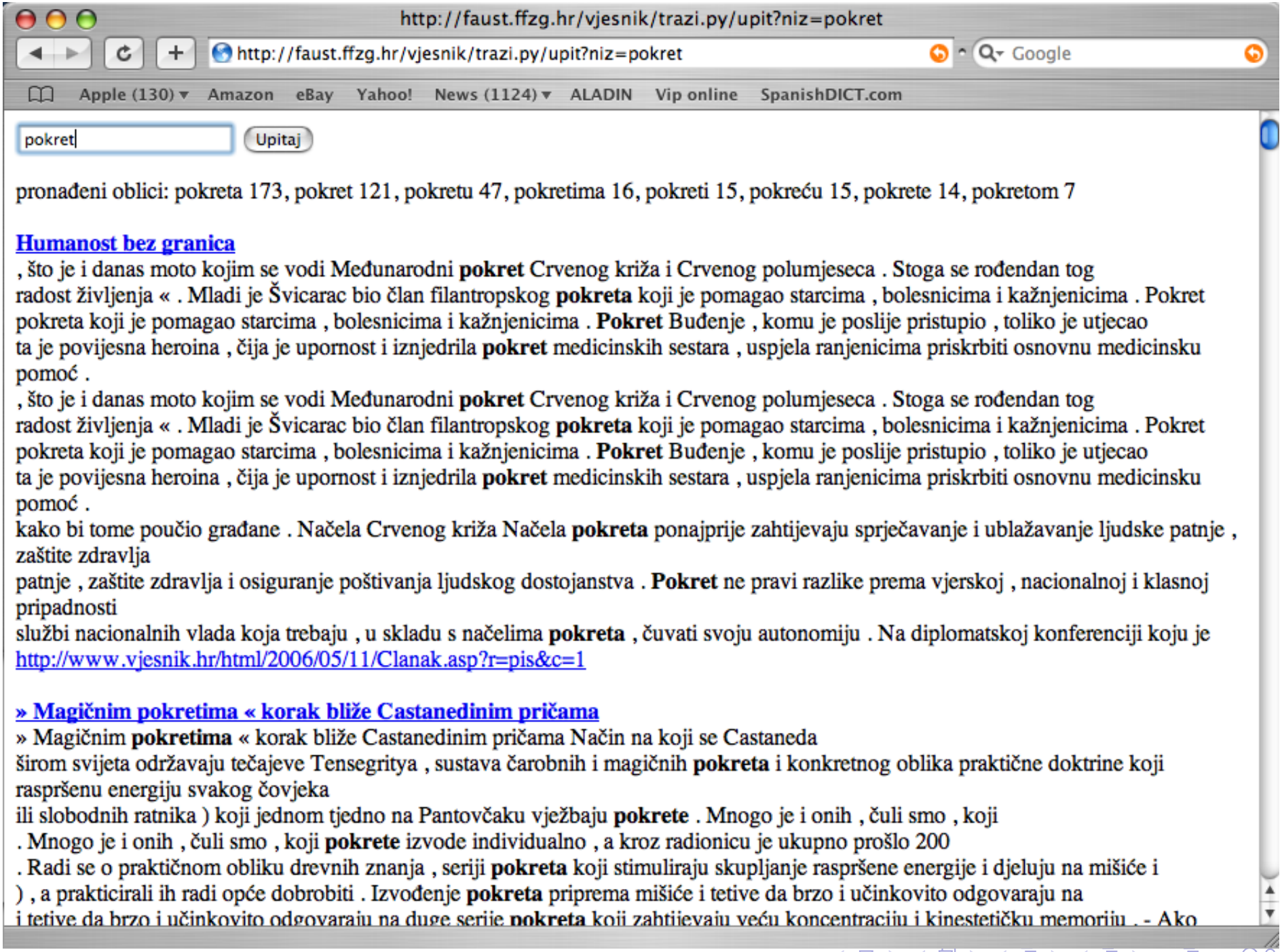
» Josipovac « , u Nazorovoj 49 , nakon intenzivne potrage i niza operativnih mjera vraćeno je u srijedu u poslijepdnevnim
M. V. (7) , zagrebačka policija je raspisala potragu . Nakon intenzivne potrage i opsežne pretrage terena , u
) , zagrebačka policija je raspisala potragu . Nakon intenzivne potrage i opsežne pretrage terena , u srijedu oko 16.15 sati
) , policija je odmah raspisala tjeralicu i započela intenzivnu potragu . Dva dana kasnije , u srijedu oko 10 sati
http://www.vjesnik.hr/html/2000/09/01/Clanak.asp?r=crn&c=4
» Policija me izbjegava , ako treba ići ću do Strasbourga «
izbjegava , ako treba ići ću do Strasbourga « Ni potraga niti očevid nisu obavljeni kako je trebalo , a od
neprestance tragali sinjskim krajem ne bi li pronašli djevojku . Potraga je završila 5. travnja kada je slučajni prolaznik Josip Bašić
osumnjičeni. « izjavio je ogorčeni Ivan Bešlić . U cilju potrage , a kasnije i istrage , Bešlić je sam javljao
urgirali u Ministarstvu započela je prava istraga , no niti potraga , niti očevid , nisu obavljeni kako je trebalo «
http://www.vjesnik.hr/html/2002/07/25/Clanak.asp?r=crn&c=1
Suprug sumnja da mu je žena oteta i primorana na prostituciju
uredne dokumente , a za Jadrankom još nije bila raspisana potraga , nije bilo razloga za policijsku intervenciju . Upravo tu
Jedino što policiji zasad preostaje , je , nakon raspisane potrage po Hrvatskoj , raspisati i međunarodnu potragu .
, nakon raspisane potrage po Hrvatskoj , raspisati i međunarodnu potragu .
http://www.vjesnik.hr/html/2005/01/17/Clanak.asp?r=crn&c=3
Opozvana potraga za brodom sa 180 ilegalnih useljenika
Opozvana potraga za brodom sa 180 ilegalnih useljenika RIM , 13. veljače
13. veljače - Talijanska obalna straža u ponedjeljak je opozvala potragu za brodom , na kojem se smatra da je oko
Obalna straža iz talijanske luke Bari priopćila je da je potraga za nestalim brodom završila , te da nisu ništa pronašli
http://www.vjesnik.hr/html/2001/02/14/Clanak.asp?r=sss&c=4


http://faust.ffzg.hr/vjesnik/trazi.py/upit?niz=pokret
http://faust.ffzg.hr/vjesnik/trazi.py/upit?niz=pokret
Google
Apple (130)
Amazon
eBay
Yahoo!
News (1124)
ALADIN
Vip online
SpanishDICT.com
pokret
Upitaj
pronađeni oblici: pokreta 173, pokret 121, pokretu 47, pokretima 16, pokreti 15, pokreću 15, pokrete 14, pokretom 7
Humanost bez granica
, što je i danas moto kojim se vodi Međunarodni pokret Crvenog križa i Crvenog polumjeseca . Stoga se rođendan tog
radost življenja « . Mladi je Švicarac bio član filantropskog pokreta koji je pomagao starcima , bolesnicima i kažnjenicima . Pokret
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kako bi tome poučio građane . Načela Crvenog križa Načela pokreta ponajprije zahtijevaju sprječavanje i ublažavanje ljudske patnje ,
zaštite zdravlja
patnje , zaštite zdravlja i osiguranje poštivanja ljudskog dostojanstva . Pokret ne pravi razlike prema vjerskoj , nacionalnoj i klasnoj
pripadnosti
službi nacionalnih vlada koja trebaju , u skladu s načelima pokreta , čuvati svoju autonomiju . Na diplomatskoj konferenciji koju je
http://www.vjesnik.hr/html/2006/05/11/Clanak.asp?r=pis&c=1
» Magičnim pokretima « korak bliže Castanedinim pričama
» Magičnim pokretima « korak bliže Castanedinim pričama Način na koji se Castaneda
širom svijeta održavaju tečajeve Tensegritya , sustava čarobnih i magičnih pokreta i konkretnog oblika praktične doktrine koji
raspršenu energiju svakog čovjeka
ili slobodnih ratnika) koji jednom tjedno na Pantovčaku vježbaju pokrete . Mnogo je i onih , čuli smo , koji
. Mnogo je i onih , čuli smo , koji pokrete izvode individualno , a kroz radionicu je ukupno prošlo 200
. Radi se o praktičnom obliku drevnih znanja , seriji pokreta koji stimuliraju skupljanje raspršene energije i djeluju na mišiće i
) , a prakticirali ih radi opće dobrobiti . Izvođenje pokreta priprema mišiće i tetive da brzo i učinkovito odgovaraju na
i tetive da brzo i učinkovito odgovaraju na duge serije pokreta koji zahtijevaju veću koncentraciju i kinestetičku memoriju . - Ako

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