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# **ParadoxCatcher Documentation**

***Release 0.1***

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ParadoxCatcher is a tool to generate valid configurations for spoofing to resist web tracking. This tool works in four modes, namely Model Builder, Paradox Catcher (not to be confused with the name of the tool itself), Valid Spoof Generator and Dependency finder. You can get the help using the -h flag:

```
$ ../main.py -h
usage: main.py [-h]
               (-m sqlDB uthreshold filename | -c modelfile configfile | -s modelfile_
↳ dthreshold | -d modelfile attribute value dthreshold)

ParadoxCatcher: a tool for generating valid browser configuration for spoofing
to resist web tracking.

optional arguments:
  -h, --help            show this help message and exit

  -m sqlDB uthreshold filename, --model sqlDB uthreshold filename
                        Generate the model file (filename) using the my
                        database (sqlDB) and Uniqueness Threshold (uthreshold)
  -c modelfile configfile, --catcher modelfile configfile
                        Reveals the paradoxes in a set of configuration stored
                        in a configfile in json format, based on the model in
                        modelfile .
  -s modelfile dthreshold, --spoofgenerator modelfile dthreshold
                        Generates a random set of attributes/values to be
                        spoofed without causing a paradox.
  -d modelfile attribute value dthreshold, --dependency modelfile attribute value_
↳ dthreshold
                        Finding the dependencies of a target attribute/value
                        to prevent paradoxes
```

Each of the modes and corresponding usage and examples are discussed and presented in the following sections:



# CHAPTER 1

## Model Builder

The model builder is a preprocessing stage that identifies sources of technical inconsistencies and provides stochastic information about distribution of various configurations. As the name implies, this tool builds the model file based on the pseudocode provided in Listing 1 in the paper. To build the model, Model Builder takes as input a dataset of web fingerprints as well as a Uniqueness Threshold, builds the model and saves it as a cPickle file. This file is later used in the other modes make an inference based on the input.

Example usage and output:

```
$ ./main.py -m fingerprint 100 ./model_files/extracted_data_freq100.pickle

Username: root
Password:
List of attributes in the dataset:
counter, id, addressHttp, time, userAgentHttp, acceptHttp, hostHttp, connectionHttp,
↳encodingHttp, languageHttp, orderHttp, pluginsJS, platformJS, cookiesJS, dntJS,
↳timezoneJS, resolutionJS, localJS, sessionJS, IEDataJS, canvasJS, webGLJs,
↳fontsFlash, resolutionFlash, languageFlash, platformFlash, adBlock, vendorWebGLJS,
↳rendererWebGLJS, octaneScore, sunspiderTime, pluginsJSHashed, canvasJSHashed,
↳webGLJsHashed, fontsFlashHashed
Please input the irrelevant parameters in the dataset separated by a comma or press
↳Enter to continue:octaneScore, sunspiderTime, timezoneJS, id, counter, time
5.000000% of columns are done...
11.000000% of columns are done...
14.000000% of columns are done...
17.000000% of columns are done...
20.000000% of columns are done...
22.000000% of columns are done...
25.000000% of columns are done...
28.000000% of columns are done...
31.000000% of columns are done...
34.000000% of columns are done...
37.000000% of columns are done...
40.000000% of columns are done...
45.000000% of columns are done...
```

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```
48.000000% of columns are done...
51.000000% of columns are done...
54.000000% of columns are done...
57.000000% of columns are done...
60.000000% of columns are done...
62.000000% of columns are done...
65.000000% of columns are done...
68.000000% of columns are done...
71.000000% of columns are done...
74.000000% of columns are done...
77.000000% of columns are done...
80.000000% of columns are done...
88.000000% of columns are done...
91.000000% of columns are done...
94.000000% of columns are done...
97.000000% of columns are done...
Model with uniqueness threshold of 100 was built in 50 seconds.
```



## CHAPTER 2

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### Paradox Catcher

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In this mode, a browser configuration, i.e. set of attributes, is provided as input to the tool, and the output will reveal paradoxical attributes in the following format:

*Paradox\_type* (confidence, number\_of\_instances) source\_attribute=source\_attribute\_value target\_attribute=target\_attribute\_value

In the case of a hard paradox, the possible non-paradoxical values will be output as well. The lookup order to produce the output in the model is as follows: source attribute, source attribute value, target attribute, target value and its probability. In the case that a source or target attribute is not included in the model, the tool disregards that attribute. Such an occurrence is highly likely a weakness in the statistical model due to either a Uniqueness Threshold that is too high, or an original dataset that is too small. To do otherwise would induce artificial changes in the possibility of a paradox occurring or not.

Example usage and output:

```
$ ./main.py -c ./model_files/extracted_data_freq1.pickle test_config.txt

List of attributes in the model:
acceptHttp, cookiesJS, languageHttp, fontsFlashHashed, platformFlash, id, orderHttp,
↪ IEDataJS, connectionHttp, resolutionJS, canvasJS, fontsFlash, languageFlash,
↪ sunspiderTime, adBlock, timezoneJS, pluginsJS, sessionJS, vendorWebGLJS, dntJS,
↪ userAgentHttp, encodingHttp, resolutionFlash, addressHttp, WebGLJs, octaneScore,
↪ hostHttp, canvasJSHashed, WebGLJsHashed, rendererWebGLJS, localJS, platformJS,
↪ pluginsJSHashed
Please input the irrelevant parameters in the dataset separated by a comma or press
↪ Enter to continue:
Checking config 1 out of 1 for paradoxes:
Soft Paradox detected
confidence = 17.349218%, instances = 154:
acceptHttp = text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.
↪ 8 and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 29.456441%, instances = 378:
acceptHttp = text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.
↪ 8 and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1 (continues on next page)
```

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```

Soft Paradox detected
confidence = 11.041158%, instances = 306:
cookiesJS = yes and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 34.327536%, instances = 828:
cookiesJS = yes and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 24.561404%, instances = 73:
languageHttp = en-US,en;q=0.8 and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 32.631579%, instances = 169:
languageHttp = en-US,en;q=0.8 and addressHttp = ↵
↪7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 81.508772%, instances = 168:
languageHttp = en-US,en;q=0.8 and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; ↵
↪Nexus 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 ↵
↪Mobile Safari/537.36

Soft Paradox detected
confidence = 99.719298%, instances = 12:
languageHttp = en-US,en;q=0.8 and platformJS = iPad

Soft Paradox detected
confidence = 13.683413%, instances = 135:
fontsFlashHashed = ce30cd74ffc46157d73983a8599d5ed2d2564260 and id = cde0cf74-70e2-
↪4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 31.961626%, instances = 493:
fontsFlashHashed = ce30cd74ffc46157d73983a8599d5ed2d2564260 and addressHttp = ↵
↪7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 13.683413%, instances = 135:
platformFlash = Flash not detected and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 31.961626%, instances = 493:
platformFlash = Flash not detected and addressHttp = ↵
↪7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 3.381764%, instances = 1:
orderHttp = Upgrade-Insecure-Requests Referer Connection Accept X-Real-IP Accept-
↪Language Accept-Encoding User-Agent Host and id = cde0cf74-70e2-4a40-9a6c-
↪4703f9c2557b

Soft Paradox detected
confidence = 13.577154%, instances = 119:
orderHttp = Upgrade-Insecure-Requests Referer Connection Accept X-Real-IP Accept-
↪Language Accept-Encoding User-Agent Host and addressHttp = ↵
↪7f6b9228e8c60669fff2ff610af55b67e0f43ce1

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```

Soft Paradox detected
confidence = 99.724449%, instances = 11:
orderHttp = Upgrade-Insecure-Requests Referer Connection Accept X-Real-IP Accept-
→Language Accept-Encoding User-Agent Host and platformJS = iPad

Soft Paradox detected
confidence = 29.881040%, instances = 338:
connectionHttp = close and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 45.603385%, instances = 1223:
connectionHttp = close and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 3.016241%, instances = 3:
resolutionJS = 360x640x32 and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 1.392111%, instances = 2:
resolutionJS = 360x640x32 and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 99.535963%, instances = 3:
resolutionJS = 360x640x32 and platformJS = iPad

Soft Paradox detected
confidence = 13.043478%, instances = 2:
canvasJS = and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 52.173913%, instances = 4:
canvasJS = and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/
→M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/
→537.36

** Hard Paradox detected **
confidence = 100.000000%, instances = 4:
canvasJS = and platformJS = iPad
platformJS must be either of the followings:
[u'Win32', u'Linux armv8l', u'Linux armv7l', u'MacIntel']

Soft Paradox detected
confidence = 13.683413%, instances = 135:
fontsFlash = Flash not detected and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 31.961626%, instances = 493:
fontsFlash = Flash not detected and addressHttp =
→7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 13.683413%, instances = 135:
languageFlash = Flash not detected and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 31.961626%, instances = 493:

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```

languageFlash = Flash not detected and addressHttp =
↳7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and canvasJS =

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and adBlock =
↳yes

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and
↳vendorWebGLJS = Not supported

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and WebGLJs =
↳Not supported

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and
↳canvasJSHashed = da39a3ee5e6b4b0d3255bfef95601890afd80709

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and
↳webGLJsHashed = 8e635455c1c04acc72cc3cb8b3930fa2002922c7

Soft Paradox detected
confidence = 83.333333%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and
↳rendererWebGLJS = Not supported

** Hard Paradox detected **
confidence = 100.000000%, instances = 1:
userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/
↳537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36 and platformJS
↳= iPad
platformJS must be either of the followings:
[u'Linux armv7l']

Soft Paradox detected
confidence = 15.089188%, instances = 132:
adBlock = yes and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected

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confidence = 30.123771%, instances = 307:
adBlock = yes and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 86.548963%, instances = 262:
adBlock = yes and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5 Build/
↳M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile Safari/
↳537.36

Soft Paradox detected
confidence = 14.551334%, instances = 46:
timezoneJS = -120 and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 36.580437%, instances = 172:
timezoneJS = -120 and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 79.506871%, instances = 147:
timezoneJS = -120 and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5
↳Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile
↳Safari/537.36

Soft Paradox detected
confidence = 19.559734%, instances = 91:
pluginsJS = and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 37.858289%, instances = 303:
pluginsJS = and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 10.376735%, instances = 283:
sessionJS = yes and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 32.699934%, instances = 765:
sessionJS = yes and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 20.434265%, instances = 182:
vendorWebGLJS = Not supported and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 42.058299%, instances = 490:
vendorWebGLJS = Not supported and addressHttp =
↳7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 86.302796%, instances = 304:
vendorWebGLJS = Not supported and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1;
↳Nexus 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87
↳Mobile Safari/537.36

Soft Paradox detected
confidence = 8.892356%, instances = 141:
dntJS = NC and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

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```

Soft Paradox detected
confidence = 28.432137%, instances = 438:
dntJS = NC and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 10.375878%, instances = 283:
localJS = yes and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 32.705494%, instances = 765:
localJS = yes and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 16.777267%, instances = 133:
encodingHttp = gzip, deflate, sdch, br and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 28.654075%, instances = 305:
encodingHttp = gzip, deflate, sdch, br and addressHttp =
↳ 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 99.931938%, instances = 11:
encodingHttp = gzip, deflate, sdch, br and platformJS = iPad

Soft Paradox detected
confidence = 13.683413%, instances = 135:
resolutionFlash = Flash not detected and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 31.961626%, instances = 493:
resolutionFlash = Flash not detected and addressHttp =
↳ 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 14.679937%, instances = 306:
IEDataJS = no and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 36.266305%, instances = 884:
IEDataJS = no and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 26.640927%, instances = 90:
webGLJS = Not supported and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 50.096525%, instances = 259:
webGLJS = Not supported and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 78.474903%, instances = 180:
webGLJS = Not supported and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus
↳ 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile
↳ Safari/537.36

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```

Soft Paradox detected
confidence = 14.679937%, instances = 306:
octaneScore = and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 36.266305%, instances = 884:
octaneScore = and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 29.881040%, instances = 338:
hostHttp = amiunique-backend and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 45.603385%, instances = 1223:
hostHttp = amiunique-backend and addressHttp =
↳ 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 13.043478%, instances = 2:
canvasJSHashed = da39a3ee5e6b4b0d3255bfef95601890afd80709 and addressHttp =
↳ 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 52.173913%, instances = 4:
canvasJSHashed = da39a3ee5e6b4b0d3255bfef95601890afd80709 and userAgentHttp = Mozilla/
↳ 5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like
↳ Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36

** Hard Paradox detected **
confidence = 100.000000%, instances = 4:
canvasJSHashed = da39a3ee5e6b4b0d3255bfef95601890afd80709 and platformJS = iPad
platformJS must be either of the followings:
[u'Win32', u'Linux armv8l', u'Linux armv7l', u'MacIntel']

Soft Paradox detected
confidence = 19.559734%, instances = 91:
pluginsJSHashed = da39a3ee5e6b4b0d3255bfef95601890afd80709 and id = cde0cf74-70e2-
↳ 4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 37.858289%, instances = 303:
pluginsJSHashed = da39a3ee5e6b4b0d3255bfef95601890afd80709 and addressHttp =
↳ 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 26.640927%, instances = 90:
webGLJsHashed = 8e635455c1c04acc72cc3cb8b3930fa2002922c7 and id = cde0cf74-70e2-4a40-
↳ 9a6c-4703f9c2557b

Soft Paradox detected
confidence = 50.096525%, instances = 259:
webGLJsHashed = 8e635455c1c04acc72cc3cb8b3930fa2002922c7 and addressHttp =
↳ 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 78.474903%, instances = 180:
webGLJsHashed = 8e635455c1c04acc72cc3cb8b3930fa2002922c7 and userAgentHttp = Mozilla/
↳ 5.0 (Linux; Android 6.0.1; Nexus 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like
↳ Gecko) Chrome/56.0.2924.87 Mobile Safari/537.36

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```

Soft Paradox detected
confidence = 20.434265%, instances = 182:
rendererWebGLJS = Not supported and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 42.058299%, instances = 490:
rendererWebGLJS = Not supported and addressHttp =
↳7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 86.302796%, instances = 304:
rendererWebGLJS = Not supported and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1;
↳Nexus 5 Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87
↳Mobile Safari/537.36

Soft Paradox detected
confidence = 90.789474%, instances = 9:
platformJS = iPad and languageHttp = en-US,en;q=0.8

Soft Paradox detected
confidence = 9.210526%, instances = 3:
platformJS = iPad and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b

Soft Paradox detected
confidence = 91.447368%, instances = 6:
platformJS = iPad and orderHttp = Upgrade-Insecure-Requests Referer Connection Accept
↳X-Real-IP Accept-Language Accept-Encoding User-Agent Host

Soft Paradox detected
confidence = 11.842105%, instances = 5:
platformJS = iPad and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1

Soft Paradox detected
confidence = 96.052632%, instances = 2:
platformJS = iPad and resolutionJS = 360x640x32

Soft Paradox detected
confidence = 78.947368%, instances = 10:
platformJS = iPad and canvasJS =

Soft Paradox detected
confidence = 72.368421%, instances = 9:
platformJS = iPad and userAgentHttp = Mozilla/5.0 (Linux; Android 6.0.1; Nexus 5
↳Build/M4B30Z) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/56.0.2924.87 Mobile
↳Safari/537.36

Soft Paradox detected
confidence = 96.710526%, instances = 1:
platformJS = iPad and encodingHttp = gzip, deflate, sdch, br

Soft Paradox detected
confidence = 78.947368%, instances = 10:
platformJS = iPad and canvasJSHashed = da39a3ee5e6b4b0d3255bfe95601890afd80709

Soft Paradox detected
confidence = 14.679937%, instances = 306:

```

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```
sunspiderTime = and id = cde0cf74-70e2-4a40-9a6c-4703f9c2557b
```

Soft Paradox detected

```
confidence = 36.266305%, instances = 884:
```

```
sunspiderTime = and addressHttp = 7f6b9228e8c60669fff2ff610af55b67e0f43ce1
```



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### Valid Spoof Generator

---

In this defensive mode, this tool makes a suggestion for a set of attributes and corresponding values, which if spoofed, will not be paradoxical. The suggested configuration can be used by a front-end or browser extension that spoofs browser attributes on each session.

Example usage and output:

```
$ ./main.py -s ./model_files/extracted_data_freq30.pickle 0.85

List of attributes in the model:
acceptHttp, cookiesJS, languageHttp, fontsFlashHashed, platformFlash, userAgentHttp,
↪orderHttp, IEDataJS, connectionHttp, resolutionJS, canvasJS, fontsFlash,
↪languageFlash, adBlock, pluginsJS, sessionJS, vendorWebGLJS, dntJS, encodingHttp,
↪resolutionFlash, addressHttp, webGLJs, hostHttp, canvasJSHashed, webGLJsHashed,
↪rendererWebGLJS, localJS, platformJS, pluginsJSHashed
Please input the irrelevant parameters in the dataset separated by a comma or press
↪Enter to continue:
Direct parameter: cookiesJS -> yes
Direct parameter: IEDataJS -> no
Direct parameter: connectionHttp -> close
Direct parameter: sessionJS -> yes
Direct parameter: hostHttp -> amiunique-backend
Direct parameter: localJS -> yes
```



## CHAPTER 4

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### Dependency Finder

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Several browser addons, such as User-Agent Switcher, attempt to spoof an attribute of the browser in order to defend against browser fingerprinting. As mentioned previously, a blind approach to this easily causes a paradox in the browser configuration. In dependency finder mode, the tool informs the user about the dependencies of an attribute and suggests values for them. To prevent a paradox, besides the target attribute, its dependents should be changed as well.

Example usage and output:

```
$ ./main.py -d ./model_files/extracted_data_freq30.pickle platformJS iPad 0.85

List of attributes in the model:
acceptHttp, cookiesJS, languageHttp, fontsFlashHashed, platformFlash, userAgentHttp,
↳ orderHttp, IEDataJS, connectionHttp, resolutionJS, canvasJS, fontsFlash,
↳ languageFlash, adBlock, pluginsJS, sessionJS, vendorWebGLJS, dntJS, encodingHttp,
↳ resolutionFlash, addressHttp, webGLJs, hostHttp, canvasJSHashed, webGLJsHashed,
↳ rendererWebGLJS, localJS, platformJS, pluginsJSHashed
Please input the irrelevant parameters in the dataset separated by a comma or press
↳ Enter to continue:
Direct parameter: acceptHttp -> text/html,application/xhtml+xml,application/xml;q=0.9,
↳ */*;q=0.8
Direct parameter: cookiesJS -> yes
Direct parameter: fontsFlashHashed -> ce30cd74ffc46157d73983a8599d5ed2d2564260
Direct parameter: platformFlash -> Flash not detected
Direct parameter: IEDataJS -> no
Direct parameter: connectionHttp -> close
Direct parameter: resolutionJS -> 768x1024x32
Direct parameter: fontsFlash -> Flash not detected
Direct parameter: languageFlash -> Flash not detected
Direct parameter: adBlock -> no
Direct parameter: pluginsJS ->
Direct parameter: encodingHttp -> gzip, deflate
Direct parameter: resolutionFlash -> Flash not detected
Direct parameter: hostHttp -> amiunique-backend
Direct parameter: pluginsJSHashed -> da39a3ee5e6b4b0d3255bfef95601890afd80709
```

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```
Indirect parameter: cookiesJS -> sessionJS -> yes  
Indirect parameter: cookiesJS -> localJS -> yes
```