

Object extraction techniques and visual image search with Semantic web techniques

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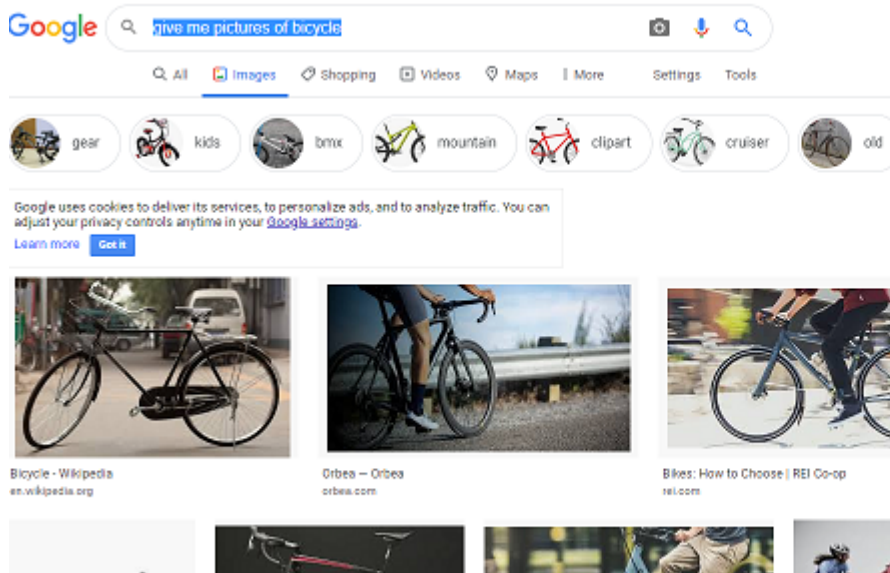
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Introduction: Just Google

- images with bicycles



Google vs Qanswer

- images with cars on the right


Google

images with cars on the right

All Images News Videos Shopping More Settings Tools

left hand drive fastest car rental lhd steering steering wheel electric cars suv

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[Learn more](#) [Get it](#)



Right hand drive is banned in Russia ...
kottanews.blogspot.com

Buying a right-hand drive car
info4information.com

List of LHD and RHD countries
PETERPATRICK

Qanswer: images with car in the right

give me pictures of car in the right

Go

Confidence :  39 %

SPARQL LIST

DID YOU MEAN

DIRECT ANSWER

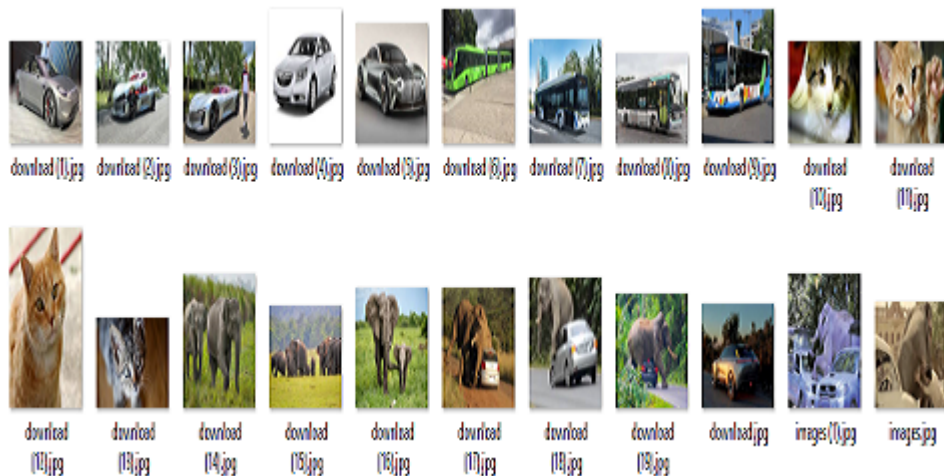
Is this the right answer? ☐ Yes ☒ No

/ has on the right / car

download (2).jpg



Initialisation of work with a set of 22 images



special Wikimedia commons api give images

<https://commons.wikimedia.org/w/api.php?action=query&list=search&srsearch=haswbstatement:P180=Q7378&srnamespace=6&format=json>

```
{
  "batchcomplete": "",
  "continue": {
    "sroffset": 10,
    "srcontinue": "-"
  },
  "query": {
    "searchinfo": {
      "totalhits": 231
    },
    "search": [
      {
        "ns": 6,
        "title": "File:African Bush Elephant.jpg",
        "pageid": 1930980,
        "size": 1517,
        "wordcount": 3,
        "snippet": "English African Bush elephant facing forward Urdu (وہلے)0627(وہلے)0616(وہلے)0616",
        "timestamp": "2008-05-18T11:59:53Z"},
      {
        "ns": 6,
        "title": "File:Itosho elephant.jpg",
        "pageid": 38113678,
        "size": 819,
        "wordcount": 1,
        "snippet": "English",
        "timestamp": "2008-06-05T11:24:03Z"},
      {
        "ns": 6,
        "title": "File:Barcelona - Mammoth sculpture.JPG",
        "pageid": 17904451,
        "size": 883,
        "wordcount": 15,
        "snippet": "I, the copyright holder of this work, hereby publish it under the following license: English",
        "timestamp": "2008-05-09T01:11:12Z"},
      {
        "ns": 6,
        "title": "File:Elephant Kruger 1883.jpg",
        "pageid": 113673,
        "size": 811,
        "wordcount": 1,
        "snippet": "English",
        "timestamp": "2008-05-20T11:32:48Z"},
      {
        "ns": 6,
        "title": "File:Loxodonta africana - drinking.jpg",
        "pageid": 2538565,
        "size": 702,
        "wordcount": 1,
        "snippet": "English",
        "timestamp": "2008-06-05T02:14:36Z"},
      {
        "ns": 6,
        "title": "File:Asian Elephant 18.jpg",
        "pageid": 5145486,
        "size": 984,
        "wordcount": 33,
        "snippet": "I, the copyright holder of this work, hereby publish it under the following license: french object has role: photographer author name string: SuperJew",
        "timestamp": "2008-06-04T19:23:44Z"},
      {
        "ns": 6,
        "title": "File:Elefante africana de sabana (Loxodonta africana). nombre nacional Kuseru (u)0606frfr, 2008-01-15, 10 19.jpg",
        "pageid": 1338110,
        "size": 966,
        "wordcount": 1,
        "snippet": "English",
        "timestamp": "2008-02-24T23:51:40Z"},
      {
        "ns": 6,
        "title": "File:African bush elephant in San Geron Zoo.jpg",
        "pageid": 15665177,
        "size": 610,
        "wordcount": 42,
        "snippet": "I, the copyright holder of this work, hereby publish it under the following license: you may select the license of your choice. English URL: https://commons",
        "timestamp": "2008-06-21T06:29:53Z"},
      {
        "ns": 6,
        "title": "File:Elefantes, Ayutthaya, Tailandia, 2003-08-23, 10 A.jpg",
        "pageid": 18383371,
        "size": 818,
        "wordcount": 15,
        "snippet": "I, the copyright holder of this work, hereby publish it under the following license: English",
        "timestamp": "2008-01-01T00:31:26Z"},
      {
        "ns": 6,
        "title": "File:Elephas maximus eye (closeup).jpg",
        "pageid": 5241197,
        "size": 597,
        "wordcount": 1,
        "snippet": "English",
        "timestamp": "2008-05-16T15:48:45Z"}
    ]
  }
}
```

special Wikimediacommons api give human hand-annotated structured data

`https://commons.wikimedia.org/wiki/File:
African_elephants,_Lake_St_Lucia_06.jpg`

Items portrayed in this file **creator**
depicts

source of file

Search to add items

nature reserve

wildlife

Terrestrial animal

Indian elephant

mammal

elephant

safari

Search to add items

Some value without a Wikidata item

- URL: <https://commons.wikimedia.org/wiki/User:Bgag>
- author name string: Bernard Gagnon
- Wikimedia username: Bgag
- object has role: photographer

Search to add items

original creation by uploader


Inception

Enter time


10 November 2017

special Wikimediacommons api give human hand-annotated structured data like copyright details

copyright status

 Search to add items
copyrighted

copyright license

 Search to add items
GNU Free Documentation License, version 1.2 or later
Creative Commons Attribution-ShareAlike 4.0 International
Creative Commons Attribution-ShareAlike 3.0 Unported
Creative Commons Attribution-ShareAlike 2.5 Generic
Creative Commons Attribution-ShareAlike 2.0 Generic
Creative Commons Attribution-ShareAlike 1.0 Generic


```
https://commons.wikimedia.org/w/api.php?action=query&list=search&srsearch=haswbstatement:
```

```
P180=Q5113&srnamespace=6&format=json
```

```
https://commons.wikimedia.org/w/api.php?  
action=query&list=search&srsearch=haswb  
statement:P180=Q7378&srnamespace=6&f  
ormat=json
```

Q7378: elephant

Q5113:bird

`https://www.mediawiki.org/wiki/API:Search`

additional parameter introduced in the special Wikimediacommons api

```
https://commons.wikimedia.org/w/api.php?action=query&list=
search&srsearch=haswbstatement:
P180=Q7378&srnamespace=6&srlimit=500&format=json
```

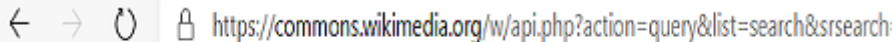
```
https://commons.wikimedia.org/w/api.php?
action=query&list=search&srsearch=haswbstatement:P180=Q7378&srnames
pace=6&srlimit=500&format=json
```

srlimit=10(by default)

srlimit=500(max value allowed)

special Wikimediacommons api gives more than 500 images for Q1420(car)

```
https://commons.wikimedia.org/w/api.php?action=query&list=search&srsearch=haswbstatement:P180=Q1420&srnamespace=6&srlimit=10&format=json&sroffset=10&continue=-||
```

A screenshot of a web browser's address bar. It shows navigation icons (back, forward, refresh) and a lock icon. The URL is <https://commons.wikimedia.org/w/api.php?action=query&list=search&srsearch=>.

```
{"batchcomplete":"","continue":{"sroffset":20,"continue":"-||"},"query":{"searchinfo":{"totalhits":2179},
1.jpg","pageid":50283159,"size":944,"wordcount":17,"snippet":"I, the copyright holder of this work, here
04-02T23:34:29Z"},"ns":6,"title":"File:Key-X Autonomous Crossover at IAA 2019 IMG 0587.jpg","pageid":82
hereby publish it under the following license: English","timestamp":"2020-06-08T19:36:40Z"},"ns":6,"tit
01.jpg","pageid":49192660,"size":1048,"wordcount":15,"snippet":"I, the copyright holder of this work, he
08T08:15:01Z"},"ns":6,"title":"File:Mercedes-Benz A 200, GIMS 2018, Le Grand-Saconnex (1X7A0529).jpg","
Blurry area English point in time: 2018","timestamp":"2020-05-25T09:44:11Z"},"ns":6,"title":"File:Land
front in" "pageid":50008703 "size":1124 "wordcount":15 "snippet":"I the copyright holder of this work
```

additional parameter, `sroffset`, introduced in the special Wikimedia commons api and we iterate over

```
https://commons.wikimedia.org/w/api.php?action=query&list=
search&srsearch=haswbstatement:P180=Q1420&srnamespace=6&
srlimit=10&format=json&sroffset=10&continue=-||
```

```
i = 10
while i <= 3000:
    i += 10
    PARAMS['srsearch'] = 'haswbstatement:P180=' + inputQid
    PARAMS['sroffset'] = i
```

Qanswer: images with bicycle in the right

give me pictures of bicycle in the right

Go

Confidence :  39 %

SPARQL LIST

Is this the right answer? ☐ Yes ☐ No

/ has on the right / bicycle

LIST

IMAGES



set of bicycle images



2016_Strzelin%2C
ul.%C5%9Awi
%C4%99tego Flo
riana_14_1.jpg



20080804_freight
_bicycle_Shangh
ai_2383.jpg



Barclays_Cycle_H
ire%2C_St._Mary
Axe%2C_Aldgate.
jpg



Chapelle_de_Bast
ide_vers_Lasbros_
DSC_0598.JPG



Cycling_Amsterd
am.jpg



Juist%2C_Altes
Warmbad_--_201
4_--_3630.jpg



M%3%B8nster
%2C_Prinzpalma
rkt_--_2014_--_46
89-93.jpg



Preah_Sihanouk_
National_Park_08
.jpg



Puch_Olympian_
12_01.jpg



Restaurant_Laska
_c%3%B4%3
%A9_rue_Terraille
_%3%A0_Lyon..

Qanswer: Image-Object Relation-contains

- person and chair

person and chair

Confidence : 57 %

[SPARQL LIST](#)

[DID YOU MEAN](#)

[DIRECT ANSWER](#)

Is this the right answer? ☒ Yes ☐ No

/ has on the bottom, has on the left, has on the right / human
/ has on the bottom, has on the left, has on the right / chairperson

https://upload.wikimedia.org/wikipedia/commons/e/eb/CEE_Spi



- Implementation of an Algorithm for object extraction.
- Design of a semantic web modelling for extracted data.
- Implementation of a visual image search engine through Qanswer.

Implementation of an Algorithm for object extraction.

YOLO-(You Only Look Once)

- Implementation of an Algorithm for object extraction.



Computer
Vision API
with
PyTorch
Framework
and use
YOLO



84	34	289	170	20	0.934078
4	36	88	162	20	0.841598
X1	Y1	X2	Y2		
					class number/class name
					confidence

Class Number, Class Name, QID

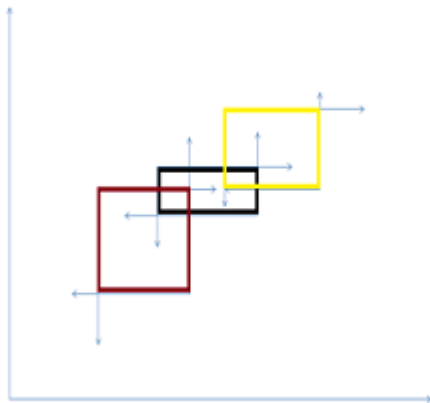
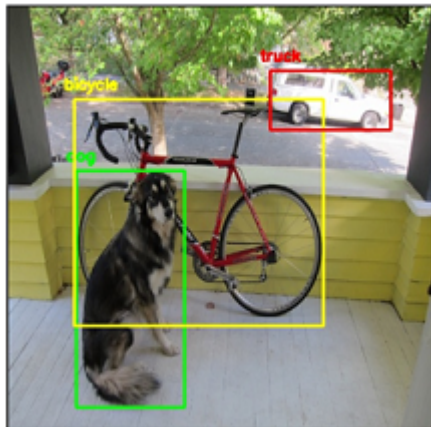
<https://github.com/pjreddie/darknet/blob/master/data/coco.names>

```
0. person-Q215627
1. bicycle-Q11442
2. car-Q1420
3. motorbike-Q34493
4. aeroplane-Q197
5. bus-Q5635
6. train-Q870
7. truck-Q43193
8. boat-Q35272
9. traffic light-Q5004
10. fire hydrant-Q634299
11. stop sign-Q250429
12. parking meter-Q953960
13. bench-Q204776
14. bird-Q5113
15. cat-Q4167836
16. dog-Q144
17. horse-Q726
18. sheep-Q7368
19. cow-Q830
20. elephant-Q7378
21. bear-Q30090244
22. zebra-Q32759
23. giraffe-Q862089
24. backpack-Q5843
25. umbrella-Q41607
26. handbag-Q467505
27. tie-Q44416
28. suitcase-Q200814
29. frisbee-Q131689
30. skis-Q172226
31. snowboard-Q178131
32. sports ball-Q63347096
33. kite-Q107061
34. baseball bat-Q809910
35. baseball glove-Q809894
36. skateboard-Q15783
37. surfboard-Q457689
```

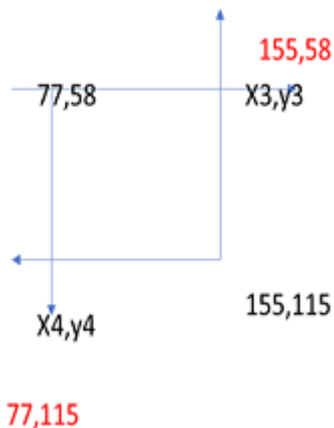
```
38. tennis racket-Q153362
39. bottle-Q50225
40. wine glass-Q1531435
41. cup-Q81727
42. fork-Q81881
43. knife-Q32489
44. spoon-Q81895
45. bowl-Q153988
46. banana-Q503
47. apple-Q89
48. sandwich-Q28803
49. orange-Q39338
50. broccoli-Q47722
51. carrot-Q81
52. hot dog-Q181055
53. pizza-Q177
54. donut-Q192783
55. cake-Q13276
56. chair-Q15026
57. sofa-Q131514
58. pottedplant-Q203834
59. bed-Q42177
60. diningtable-Q10576291
61. toilet-Q7857
62. tvmonitor-Q289
63. laptop-Q3962
64. mouse-Q7987
65. remote-Q185091
66. keyboard-Q250
67. cell phone-Q17517
68. microwave-Q127956
69. oven-Q36539
70. toaster-Q14890
71. sink-Q140565
72. refrigerator-Q37828
```

```
73. book-Q571
74. clock-Q376
75. vase-Q191851
76. scissors-Q40847
77. teddy bear-Q21347
78. hair drier-Q15004
79. toothbrush-Q13420
```

Bounding Box



Co-ordinate representation of Bounding Box



$x_3 = x_2 = 155, y_3 = y_1 = 58;$
 $x_4 = x_1 = 77, y_4 = y_2 = 115$

Image-Object Relations

Image	relation	property value
	has on the left	
	has on the right	
	has on the top	
	has on the bottom	
	has in the center	

Algorithms for Image-Object Relations

Algorithm 1 has on the left and right

```
1: if  $X - \text{centre} \leq 0.3 * X - \text{ImageDimensions}$  then  
2:    $\text{hasontheleft} \leftarrow \text{object}$   
3: else  
4:   if  $X - \text{centre} \geq 0.6 * X - \text{ImageDimensions}$  then  
5:      $\text{hasontheright} \leftarrow \text{object}$   
6:   end if  
7: end if
```

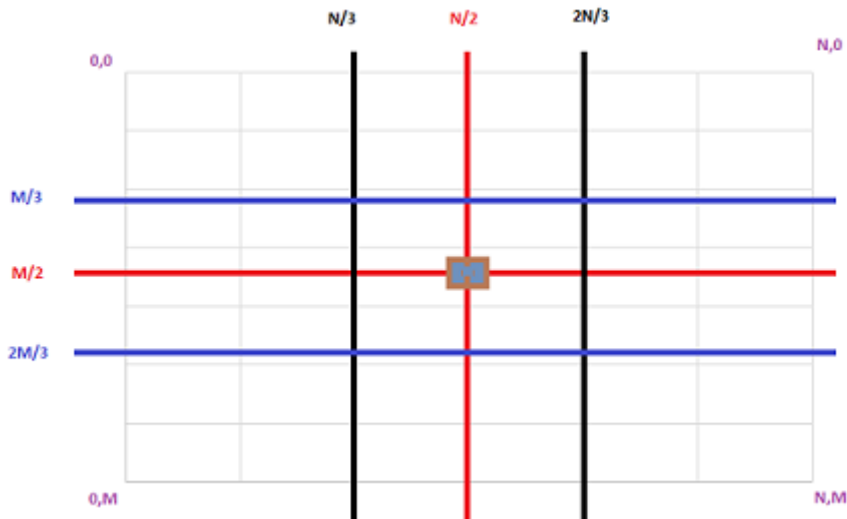
Algorithm 2 has on the top and bottom

```
1: if  $Y - \text{centre} \leq 0.3 * Y - \text{ImageDimensions}$  then  
2:    $\text{hasonthetop} \leftarrow \text{object}$   
3: else  
4:   if  $Y - \text{centre} \geq 0.6 * Y - \text{ImageDimensions}$  then  
5:      $\text{hasonthebottom} \leftarrow \text{object}$   
6:   end if  
7: end if
```

Algorithm 3 has in the center

```
1: if  $X - \text{centre} \geq 0.3 * X - \text{ImageDimensions},$   
    $X - \text{centre} \leq 0.66 * X - \text{ImageDimensions},$   
    $Y - \text{centre} \geq 0.3 * Y - \text{ImageDimensions},$   
    $Y - \text{centre} \leq 0.66 * Y - \text{ImageDimensions}$  then  
2:    $\text{hasinthecenter} \leftarrow \text{object}$ 
```

An attempt to show a graphical representation of tblrc



Using tblrc we create a csv file

X1	Y1	X2	Y2	object name	Image name	has on the left	has on the right	has on the top	has on the bottom	has in the center
190	813	3897	1932	airplane	Antonov_20	na	airplane	na	airplane	airplane
220	596	5021	1673	airplane	EBACE_20	na	airplane	na	airplane	airplane
742	1303	3933	2099	airplane	Embraer_1	na	airplane	na	airplane	airplane
889	1035	1378	1374	airplane	Kirchthurm	na	airplane	na	airplane	airplane
172	278	4018	1722	airplane	Lufthansa	na	airplane	na	airplane	airplane
331	532	2362	1245	airplane	North_Arr	na	airplane	na	airplane	airplane
1355	704	1444	813	person	North_Arr	na	person	na	person	person
833	251	2202	1761	airplane	Paris_Air	na	airplane	na	airplane	airplane
1460	1207	1579	1738	person	Playing_ir	na	person	na	person	na
224	1063	466	1813	person	Playing_ir	person	na	na	person	na
756	1286	845	1562	person	Playing_ir	person	na	na	person	na
2374	990	2486	1359	person	Playing_ir	na	person	na	person	na
468	1194	546	1264	frisbee	Playing_ir	frisbee	na	na	frisbee	na
264	273	2284	1571	airplane	RUAG_Avina	na	airplane	na	airplane	airplane

Design of a semantic web modelling for extracted data.

Image-Object Object-Object Relation

- Design of a semantic web modelling based on the csv file.

Image	relation	property value
	has on the left	
	has on the right	
	has on the top	
	has on the bottom	
	has in the center	

Subject

URI

Blank Node

Predicate

URI

Object

URI

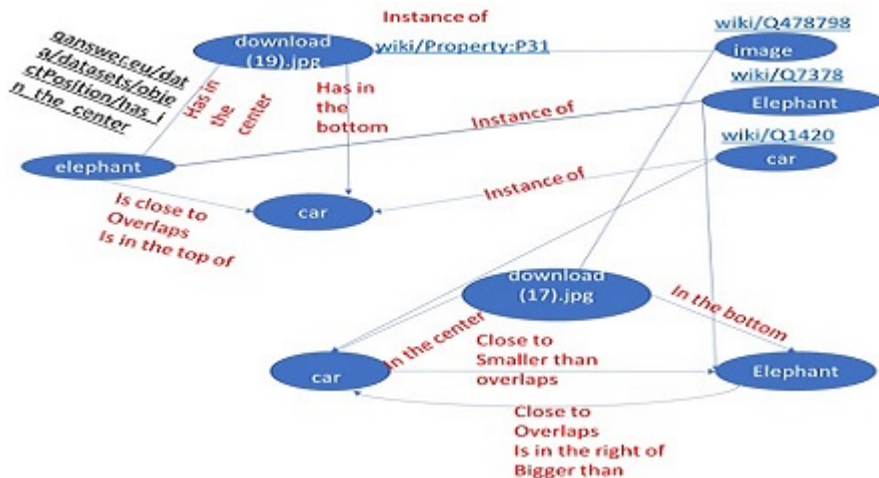
Blank Node

Literal

Design of a semantic web modelling for extracted data.

Image-Object Object-Object Relation

- Design of a semantic web modelling for extracted data.



Thereafter we use the CSV file in a Java program and convert it into a RDF file

Following this, we upload the file to QAnswer

- QAnswer: airplane in the center

give me pictures of airplane in the center

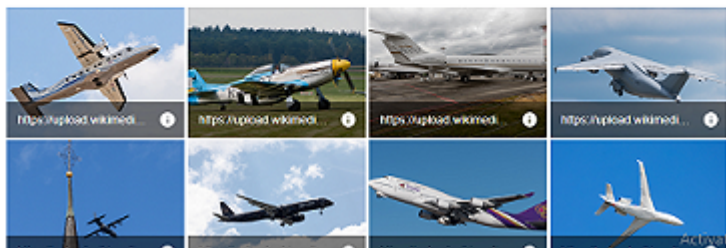
Confidence : 33 %

is this the right answer? ☐ Yes ☐ No

/ has in the center / airplane

LIST

IMAGES

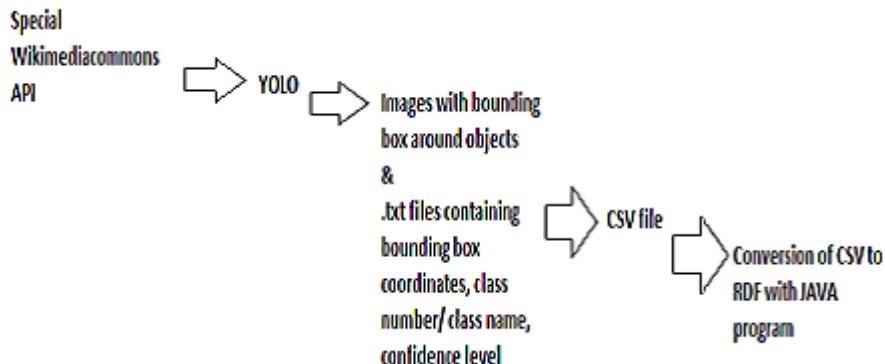


images in the left

train in the left

```
https://qanswer-frontend.univ-st-etienne.fr/user/query?  
kb=onto&user=anindamaulik
```

Automation pipeline



Limitations and Future Work

Query for images on the top

Issue with confidence of detection by YOLO

/ has on the top / clock

https://upload.wikimedia.org/wikipedia/commons/e/e7/Taipei_Rheinland-Office-Building-02.jpg





Issue with the object name assigned by YOLO

Traffic instead of Traffic Light

/ has on the top / Traffic

LIST

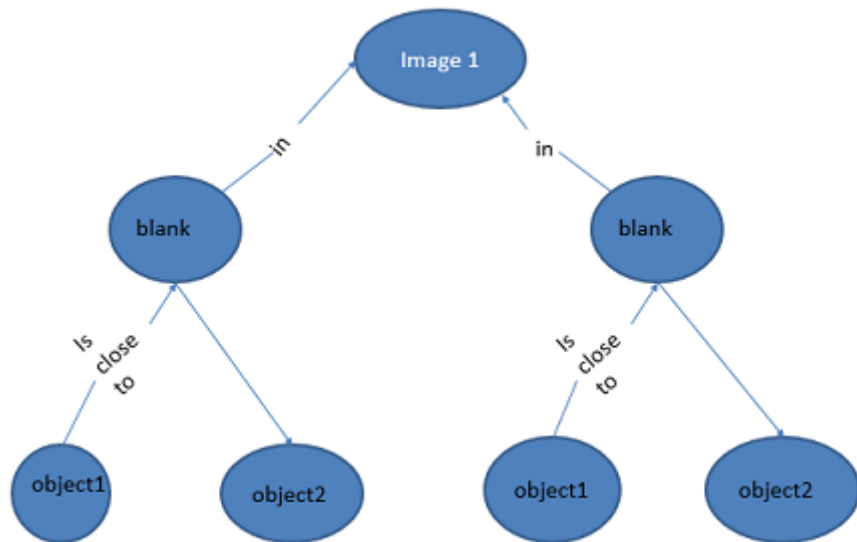
IMAGES



Object-Object Relation

Object	relation	property value
	left of	object
	right of	object
	top of	object
	bottom of	object
	close to	object
	far from	object
	overlapping with	object
	greater than	object
	smaller than	object
	% of image	value

Reified Triple



Reified Triple not being generated

give me pictures with a person on right of a car

Go

Confidence :  39 %

SPARQL LIST

Is this the right answer? ☒ Yes ☐ No

/ has on the right / human

LIST

IMAGES



OORelation algos ready to be used

Algorithm 4 is on the left and right of

```
1: if  $X - \text{centreOfObject}_1 \leq X - \text{centreOfObject}_2$  then  
2:    $\text{Object}_1\text{IsOnTheLeft} \leftarrow \text{Object}_2$   
3: else  
4:   if  $X - \text{centreOfObject}_1 \geq X - \text{centreOfObject}_2$  then  
5:      $\text{Object}_1\text{IsOnTheRight} \leftarrow \text{Object}_2$   
6:   end if  
7: end if
```

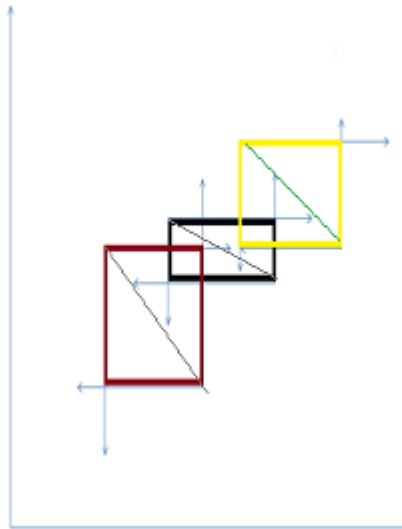
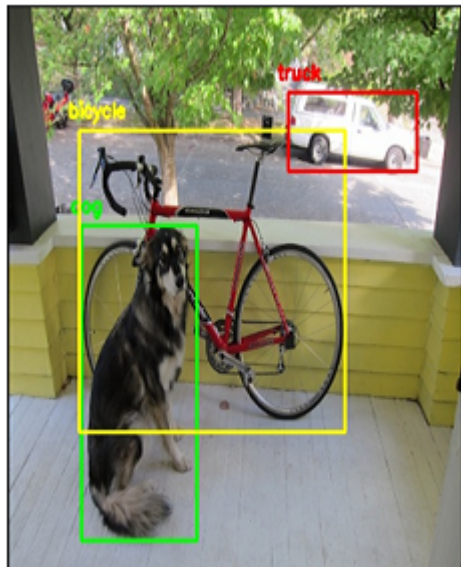
Algorithm 5 is on the top and bottom of

```
1: if  $Y - \text{centreOfObject}_1 \leq Y - \text{centreOfObject}_2$  then  
2:    $\text{Object}_1\text{IsOnTheTop} \leftarrow \text{Object}_2$   
3: else  
4:   if  $Y - \text{centreOfObject}_1 \geq Y - \text{centreOfObject}_2$  then  
5:      $\text{Object}_1\text{IsOnTheBottom} \leftarrow \text{Object}_2$   
6:   end if  
7: end if
```

Algorithm 6 close and far from

```
1: if  $\text{distance}(\text{Center1}, \text{Center2}) \leq \text{meansofdiagonalofthe2objects}$  then  
2:    $\text{Object}_1\text{IsCloseTo} \leftarrow \text{Object}_2$   
3: else  
4:   if  $\text{distance}(\text{Center1}, \text{Center2}) \geq \text{meansofdiagonalofthe2objects}$  then  
5:      $\text{Object}_1\text{IsFarFrom} \leftarrow \text{Object}_2$   
6:   end if
```

Bounding Box



OORelation algos ready to be used, contd..

Greater and Smaller Than

Algorithm 7 greater and smaller than

```
1: if  $AreaOfObject_1 \leq AreaOfObject_2$  then  
2:    $Object_1IsSmallerThan \leftarrow Object_2$   
3: else  
4:   if  $AreaOfObject_1 \geq AreaOfObject_2$  then  
5:      $Object_1IsGreaterThen \leftarrow Object_2$   
6:   end if  
7: end if
```


OORelation algos ready to be used, contd..

Overlapping With

```
from shapely.geometry import Polygon
p1 = Polygon([(0,0), (1,1), (1,0)])
p2 = Polygon([(0,1), (1,0), (1,1)])
print(p1.intersects(p2))
```

True

QAnswer issues

Not getting the right query result

- The wrong interpretation made due to non-availability of data

give me pictures of elephant on the top

Go

Confidence :  35 %

SPARQL LIST

DID YOU MEAN

DIRECT ANSWER

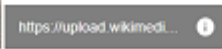
Is this the right answer? ☐ Yes ☐ No

/ instance of / image

/ has in the center, has on the bottom, has on the right, has on the left / elephant

LIST

IMAGES



In the csv file snapshot, we can see that there's data available, but not for elephant

X1	Y1	X2	Y2	object	Image name	hasinthetop
367	934	2320	3663	elephant	African_Bush_Elephant.jpg	na
660	332	2170	1659	elephant	African_bush_elephant_in_San_Diego_Zoo.jpg	na
48	383	4239	3146	elephant	Asian_Elephant_10.jpg	na
1230	452	3745	3044	elephant	Barcelona_-_Mammoth_sculpture.JPG	na
2248	1390	4036	3079	elephant	Elefantes%2CAyutthaya%2CTailandia%2C_20	na
169	1495	1788	2820	elephant	Elefantes%2CAyutthaya%2CTailandia%2C_20	na
3975	1579	4466	2618	elephant	Elefantes%2CAyutthaya%2CTailandia%2C_20	na
1545	1037	2116	1412	umbrella	Elefantes%2CAyutthaya%2CTailandia%2C_20	umbrella
3252	1038	3825	1397	umbrella	Elefantes%2CAyutthaya%2CTailandia%2C_20	umbrella
2925	701	3505	1095	umbrella	Elefantes%2CAyutthaya%2CTailandia%2C_20	umbrella
2338	1155	3143	1527	bench	Elefantes%2CAyutthaya%2CTailandia%2C_20	bench
0	1297	5668	8517	elephant	Elefante_africano_de_sabana_%28Loxodonta_a	na
388	125	1382	881	elephant	Elephant_Kruger_2003.jpg	na
323	168	1039	1328	elephant	Etosha_elefant.jpg	na
88	373	2969	2483	elephant	Loxodonta_africana_-_drinking.jpg	na

Failed to interpret the question correctly

Carina

QAnswer

About FAQ   

PROFILE

QUERY

EDIT

TRAIN EVALUATION

UPLOAD QUESTIONS

MAPPINGS

SPARQL

CONFIG

COMMUNITY

give me pictures of car in the left

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Confidence :  34 %

SPARQL LIST

DID YOU MEAN

DIRECT ANSWER

Is this the right answer? ☐ Yes ☐ No

/ has on the left / Carina

LIST

IMAGES



- Thank you for your attention, time and patience
- Please ask me any question that you have.
- Please provide your suggestion which can be used to make my work better