

Image Search

Seznam.cz

Lukáš Vrábel

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SKLIK

MAPY.CZ

Zboží.cz

FIRMY.CZ

stream.cz

EMAIL

SEZNAME.CZ

SREALITY.CZ

SPORT.CZ

SAUTO.CZ

SUPER.CZ

Novinky.cz

Image Search

Internet Obrázky Videá Články Firmy Mapy Zboží Slovník Seznam.cz

SEZNAM.CZ
Obrázky

kotátka

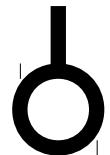
X

Vyhledat

Všechny velikosti ▾ Barevné ▾ Skrýt hanbaté



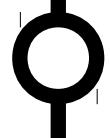
History



2007 Launch, third-party solution

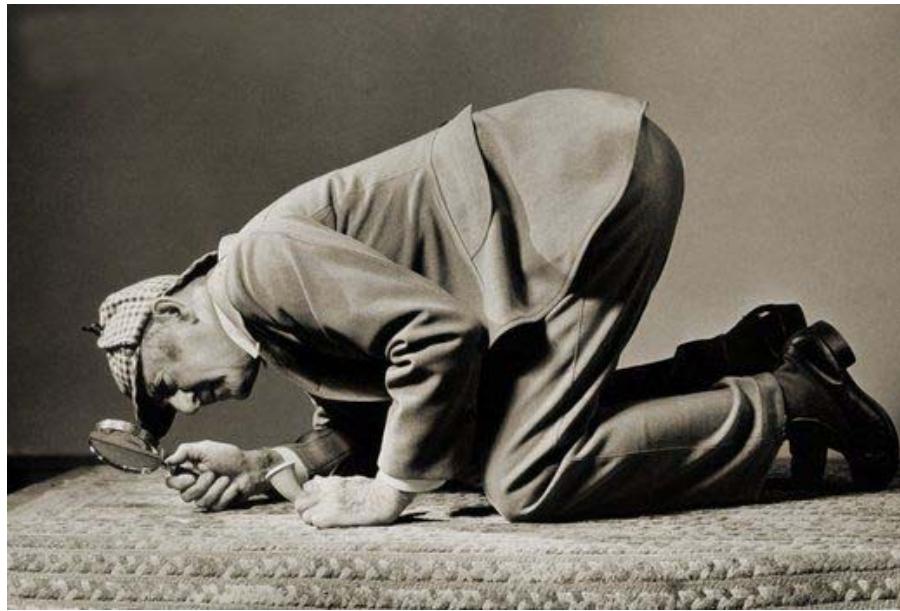


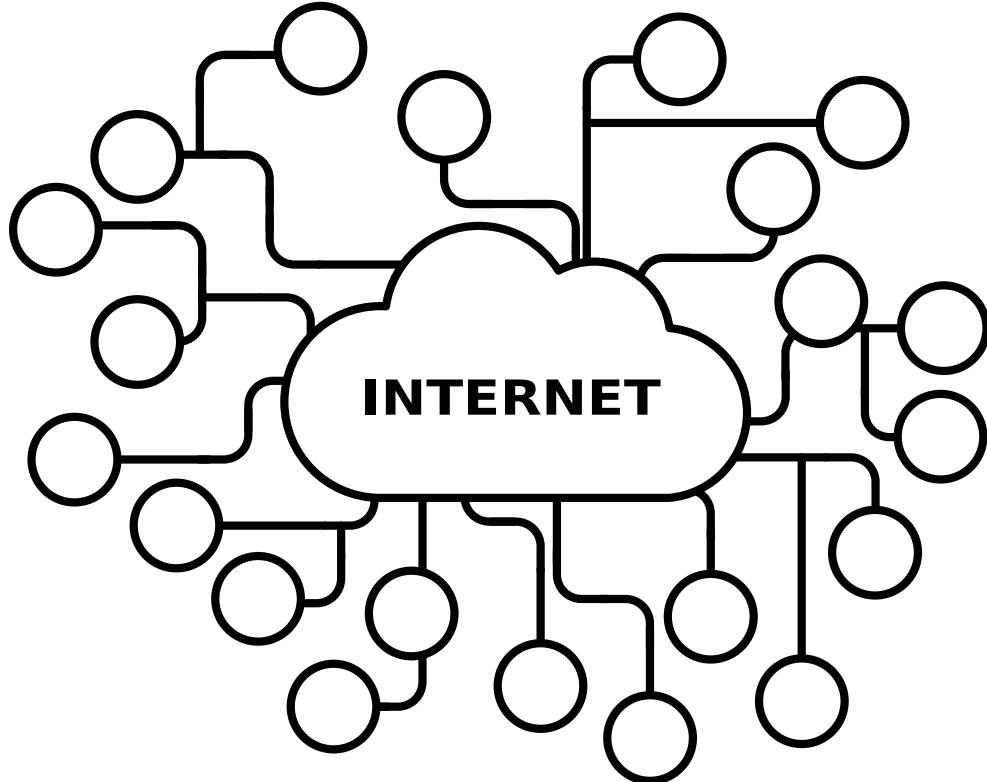
2015 Our own solution - text search

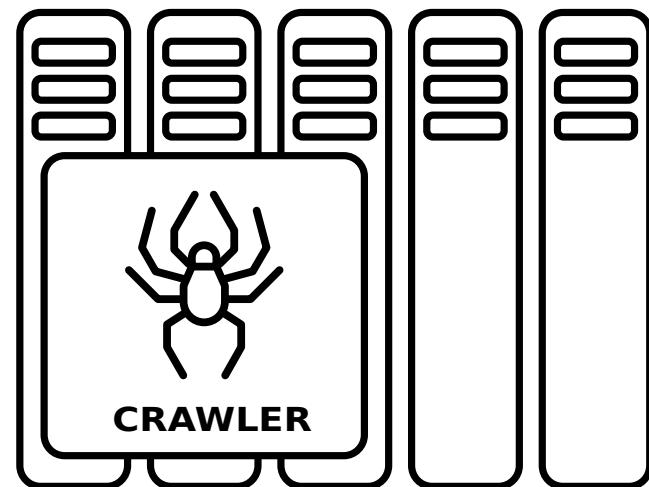
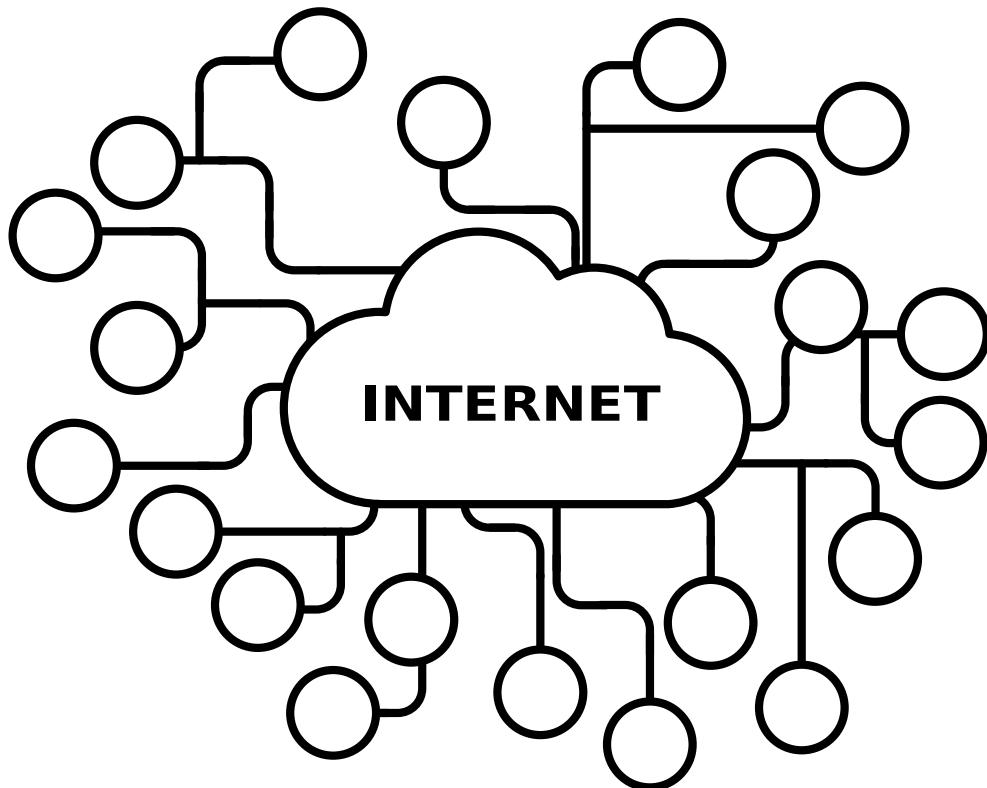


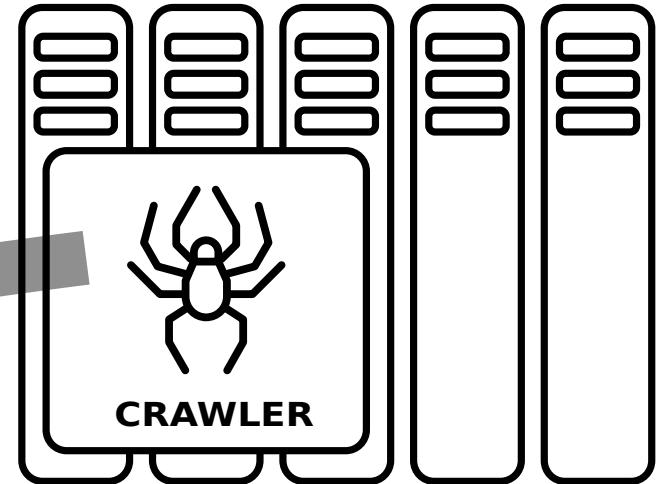
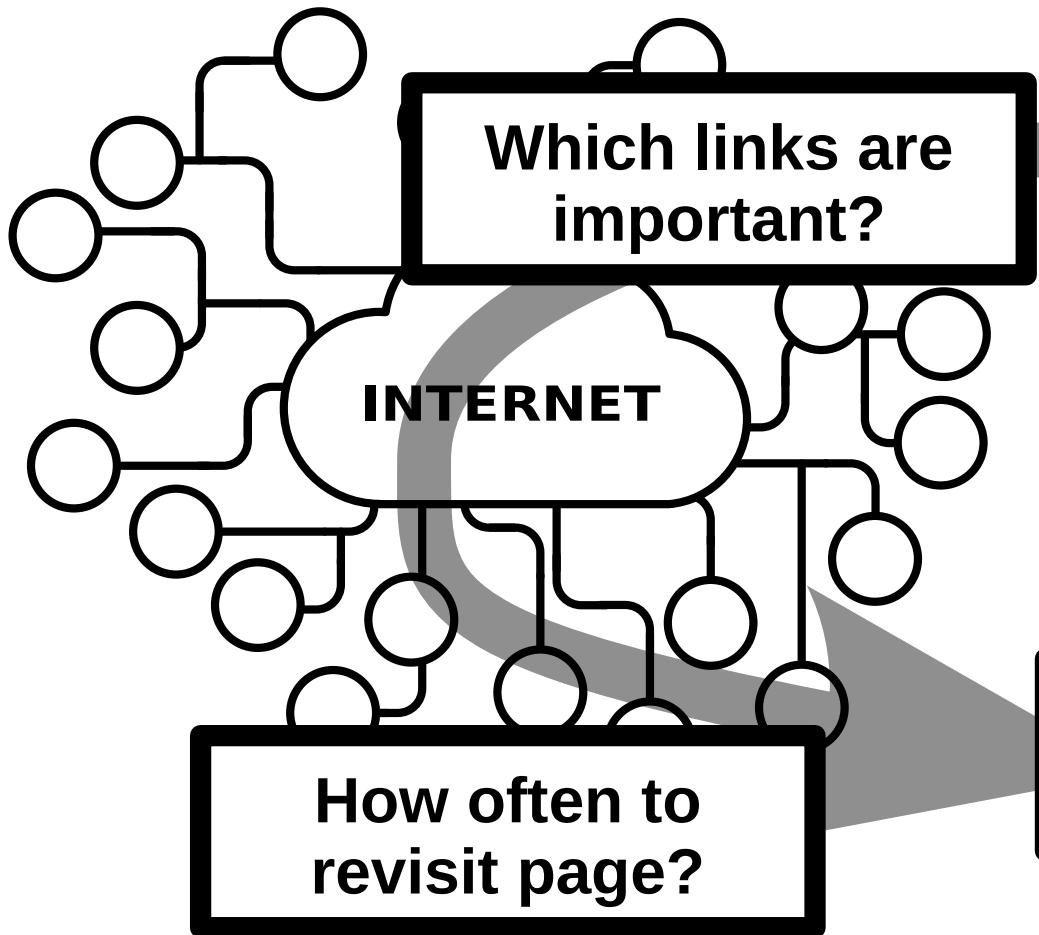
2017 Neural Networks

2015 - Basic Text Search









robocalypse

machine learning

Google

robot

Popular Posts



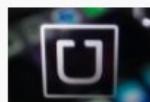
Crunch Report
| Everything
WWDC 2017
9 hours ago



Ex-Apple
designer &
former Twitter
engineer
launch Halide,
a premium
iPhone camera
app
6 days ago



Clustree grabs
\$7.9 million for
its AI-powered
recruitment
service
8 hours ago



Uber hires
Harvard
Business
School
professor
Frances Frei to
solve its
leadership
problems
37 minutes ago

Google is using machine learning to teach robots how to grasp random objects

Posted Mar 8, 2016 by **Frederic Lardinois (@fredericl)**

Using your hand to grasp a pen that's lying on your desk doesn't exactly feel like a chore, but for robots, that's still a really hard thing to do. So to teach robots how to better grasp random objects, Google's research team **dedicated 14 robots to the task**.

The standard way to solve this problem would be for the robot to survey the environment, create a plan for how to grasp the object, then execute on it. In the real world, though, lots of things can change between formulating that plan and executing on it.



Google is now using these robots to train a deep **convolutional neural network** (a technique that's all the rage in machine learning right now) to help its robots predict the outcome of their grasps based on the camera input and motor commands. It's basically hand-eye coordination for robots.

The team says that it took about 3,000 hours of practice (and 800,000 grasp attempts) before it saw "the beginnings of intelligent reactive behaviors."

"The robot observes its own gripper and corrects its motions in real time. It also exhibits

robocalypse
machine learning
Google
robot

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 Ex-Apple designer & former Twitter engineer launch Halide, a premium iPhone camera app
0 days ago

 Clustree grabs \$7.9 million for its AI-powered recruitment service
8 hours ago

 Uber hires Harvard Business School professor Frances Frei to solve its leadership problems
37 minutes ago

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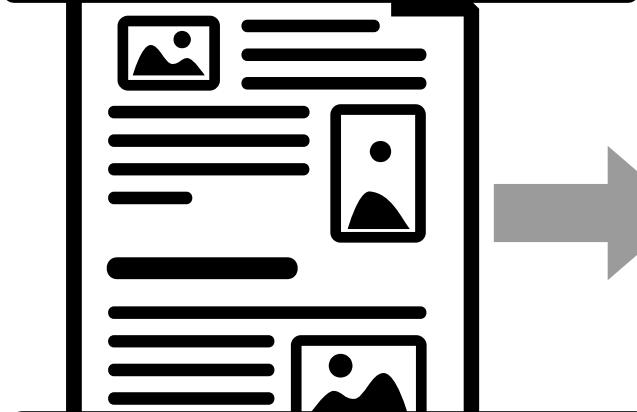
The team says that it took about 3,000 hours of practice (and 800,000 grasp attempts) before it saw "the beginnings of intelligent reactive behaviors."

"The robot observes its own gripper and corrects its motions in real time. It also exhibits

Keywords:
- robots
- plan
- grasp
- object(s)
- machine
- learning
- google



**Remove ads,
templates (BTE)**



**Extract text
close to image**



**Extract relevant
keywords**



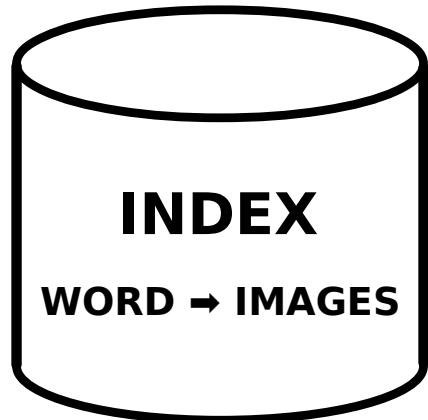
INDEX
WORD → IMAGES

METADATA
IMAGE → TEXTS

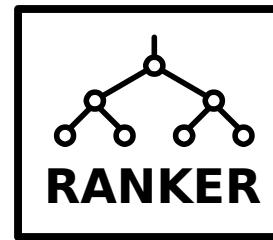
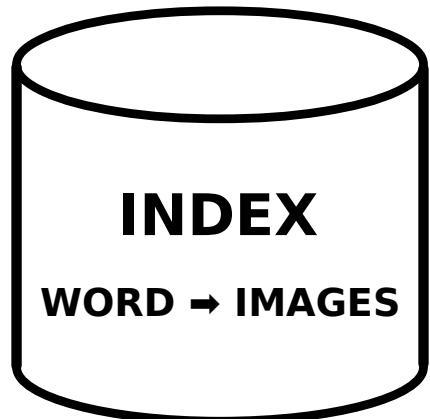
🔍 Robot grabs objects |



🔍 Robot grabs objects |

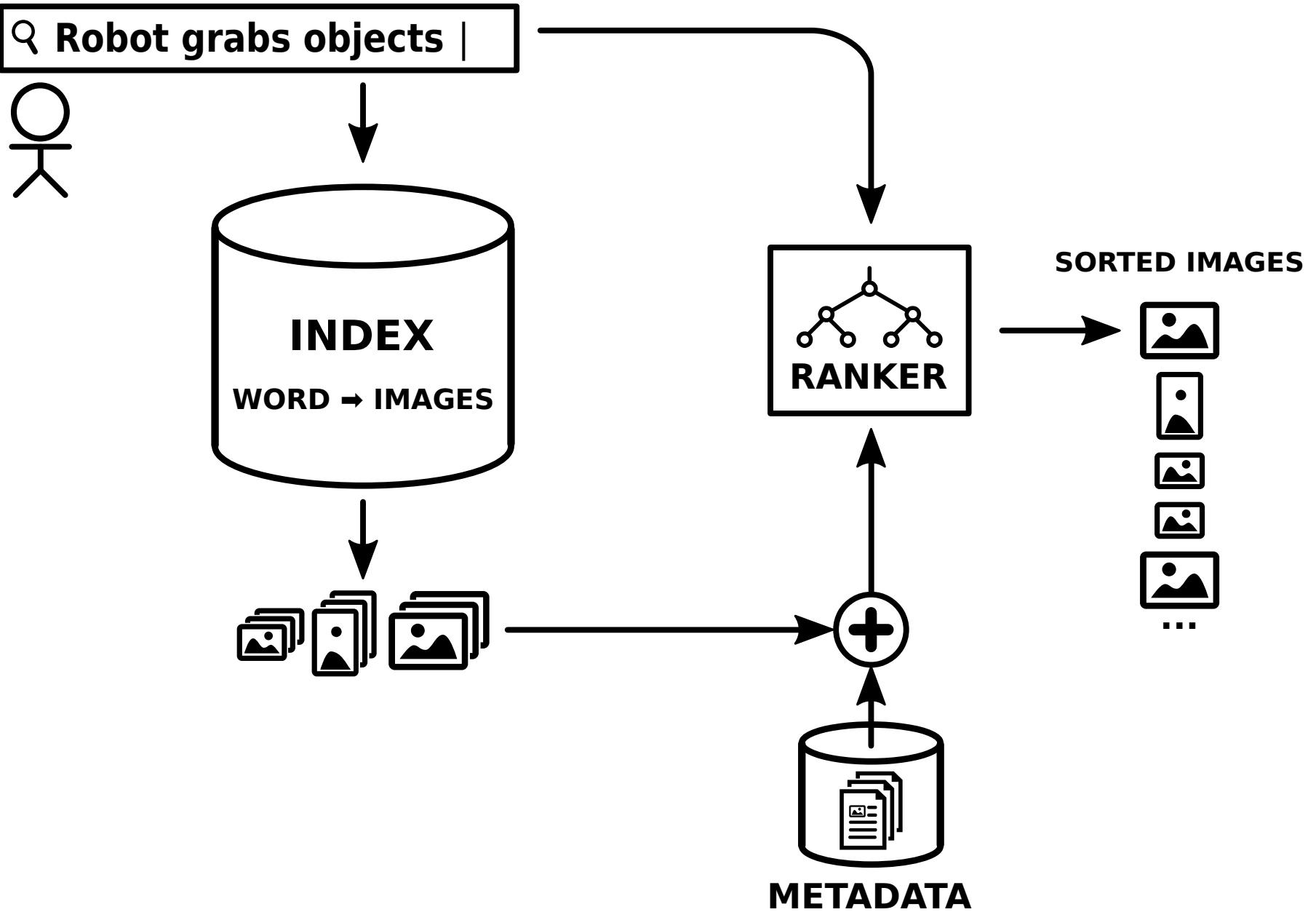


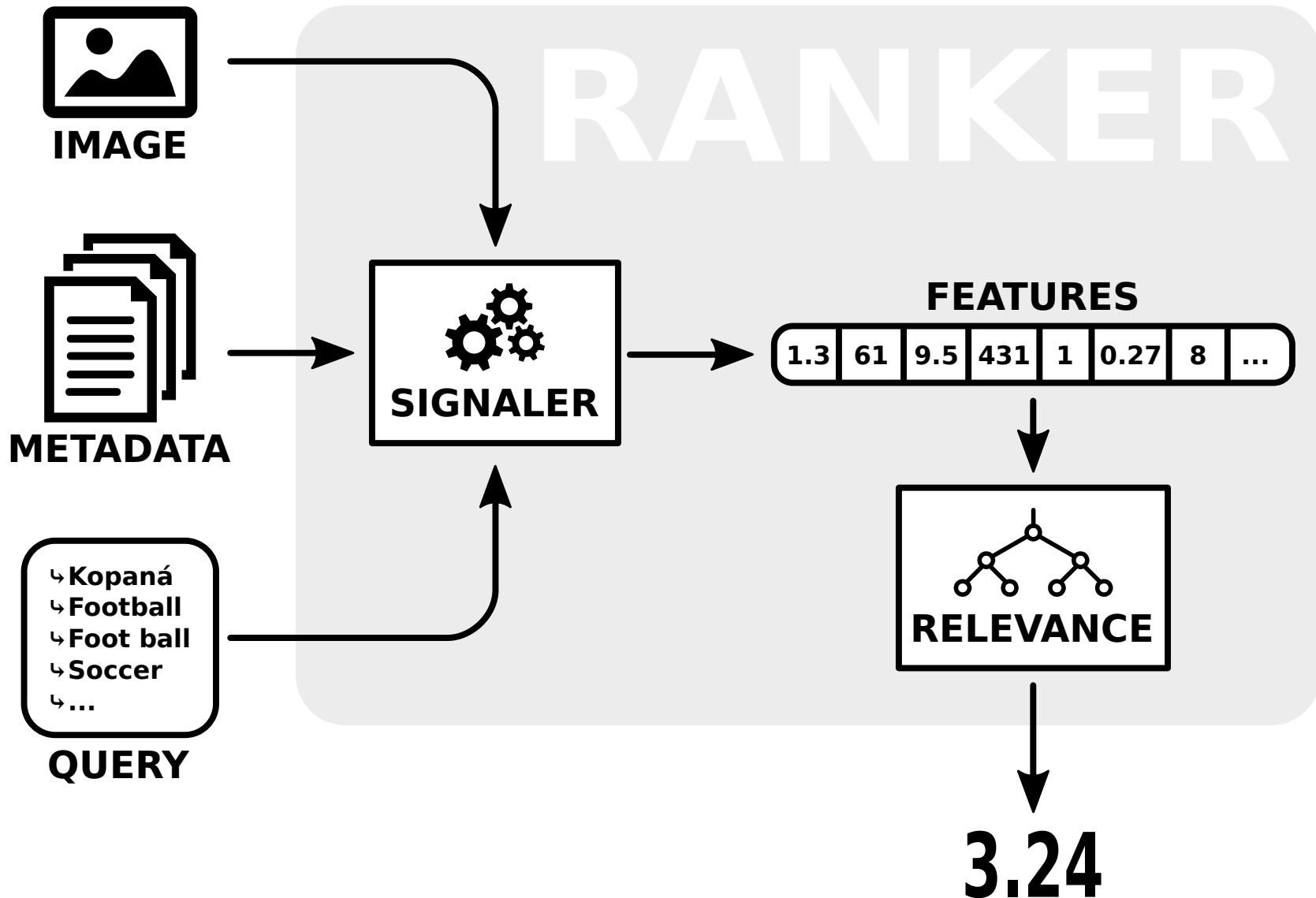
🔍 Robot grabs objects |



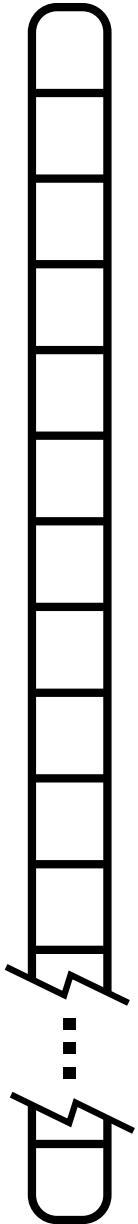
METADATA







FEATURE VECTOR



↳ Kopaná
↳ Football
↳ Foot ball
↳ Soccer
↳ ...

QUERY

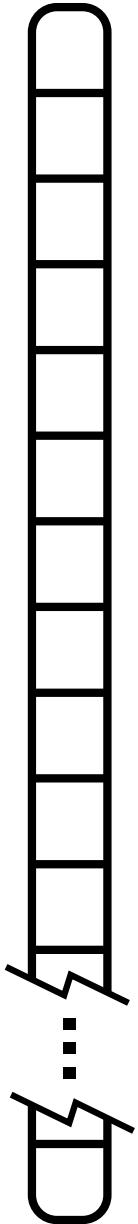


METADATA



IMAGE

FEATURE VECTOR



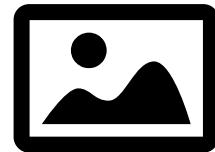
**Words from query in caption?
Words from query in title?
Words from query in url?**

- ↳ Kopaná
- ↳ Football
- ↳ Foot ball
- ↳ Soccer
- ↳ ...

QUERY

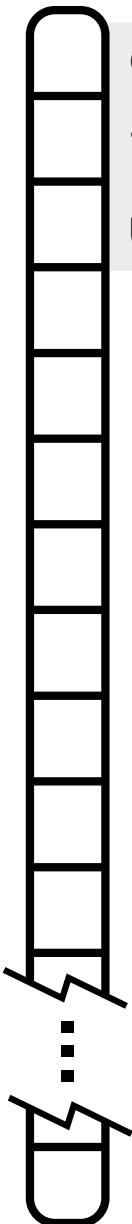


METADATA



IMAGE

FEATURE VECTOR



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url_coverage **0.2**

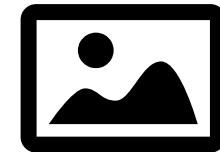


↳ Kopaná
↳ Football
↳ Foot ball
↳ Soccer
↳ ...

QUERY



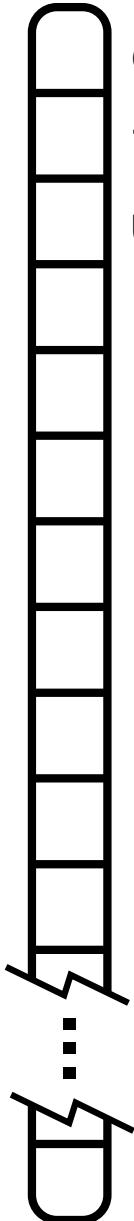
METADATA



IMAGE

Words from query in caption?
Words from query in title?
Words from query in url?

FEATURE VECTOR



caption_coverage **1.0**
title_coverage **0.8**
url_coverage **0.2**

↳ Kopaná
↳ Football
↳ Foot ball
↳ Soccer
↳ ...

QUERY



METADATA



IMAGE

**Query contains location?
GPS coords in image EXIF?
GPS close to query location?**

FEATURE VECTOR

caption_coverage **1.0**

title_coverage **0.8**

url_coverage **0.2**

query_location **1**

query_img_gps_dist **128**

img_exif_gps **1**

**Query contains location?
GPS coords in image EXIF?
GPS close to query location?**



QUERY



METADATA



IMAGE

FEATURE VECTOR

caption_coverage **1.0**
title_coverage **0.8**
url_coverage **0.2**
query_location **1**
query_img_gps_dist **128**
img_exif_gps **1**
img_size **131072**
img_bw **0**

Resolution of image?
Number of colors?

↳ Kopaná
↳ Football
↳ Foot ball
↳ Soccer
↳ ...

QUERY



METADATA

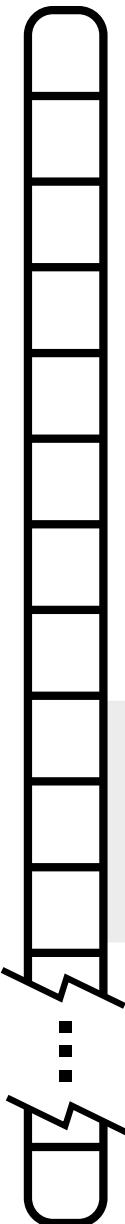


IMAGE

FEATURE VECTOR

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url_coverage **0.2**
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page_link_count **349**
page_spam_level **0.5**

...



↳ Kopaná
↳ Football
↳ Foot ball
↳ Soccer
↳ ...

QUERY

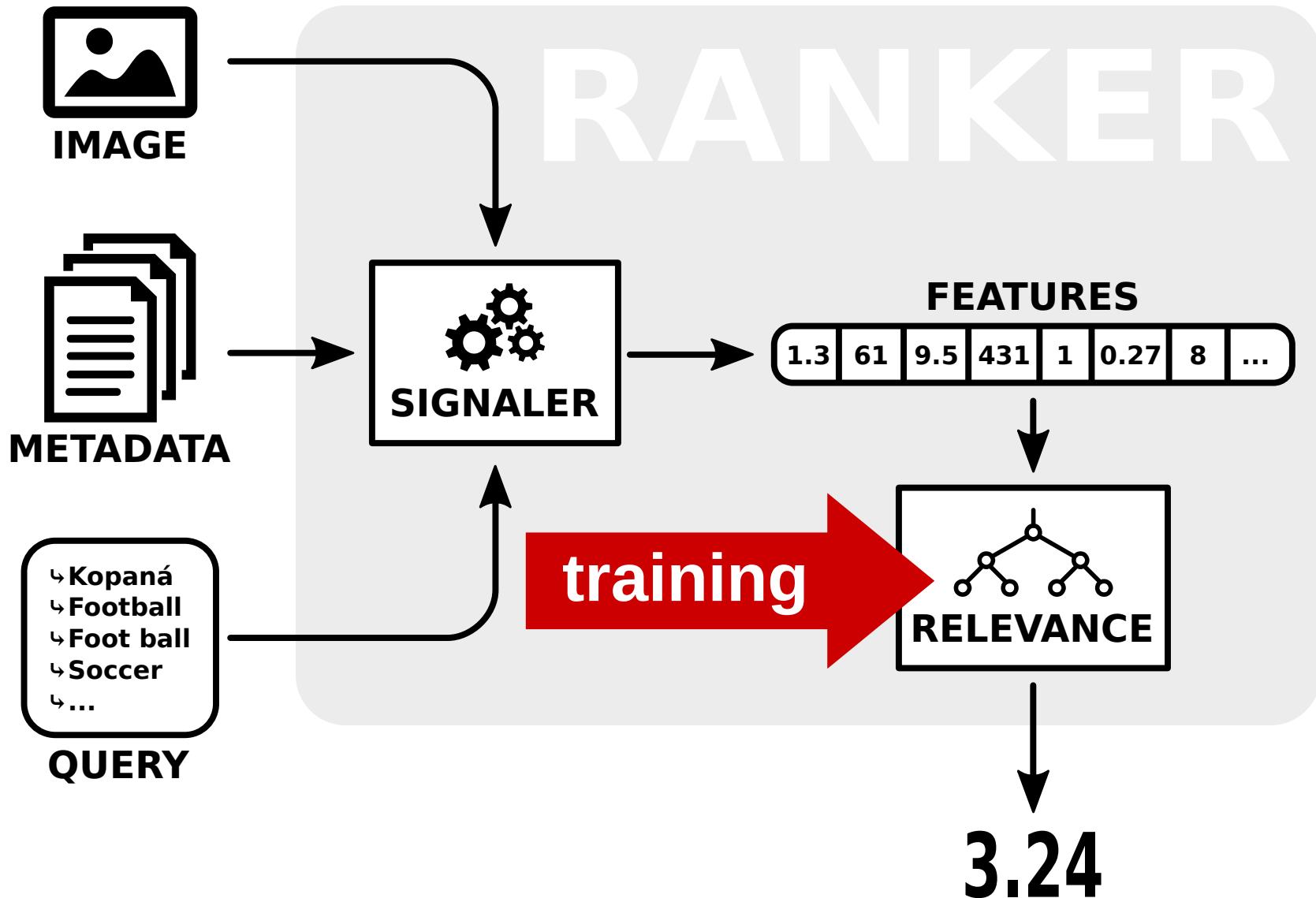


METADATA



IMAGE

image count on page?
links count on page?
spam level of page?



Annotations



Annotations

Kitten



5

5

1

3

Car



5

2

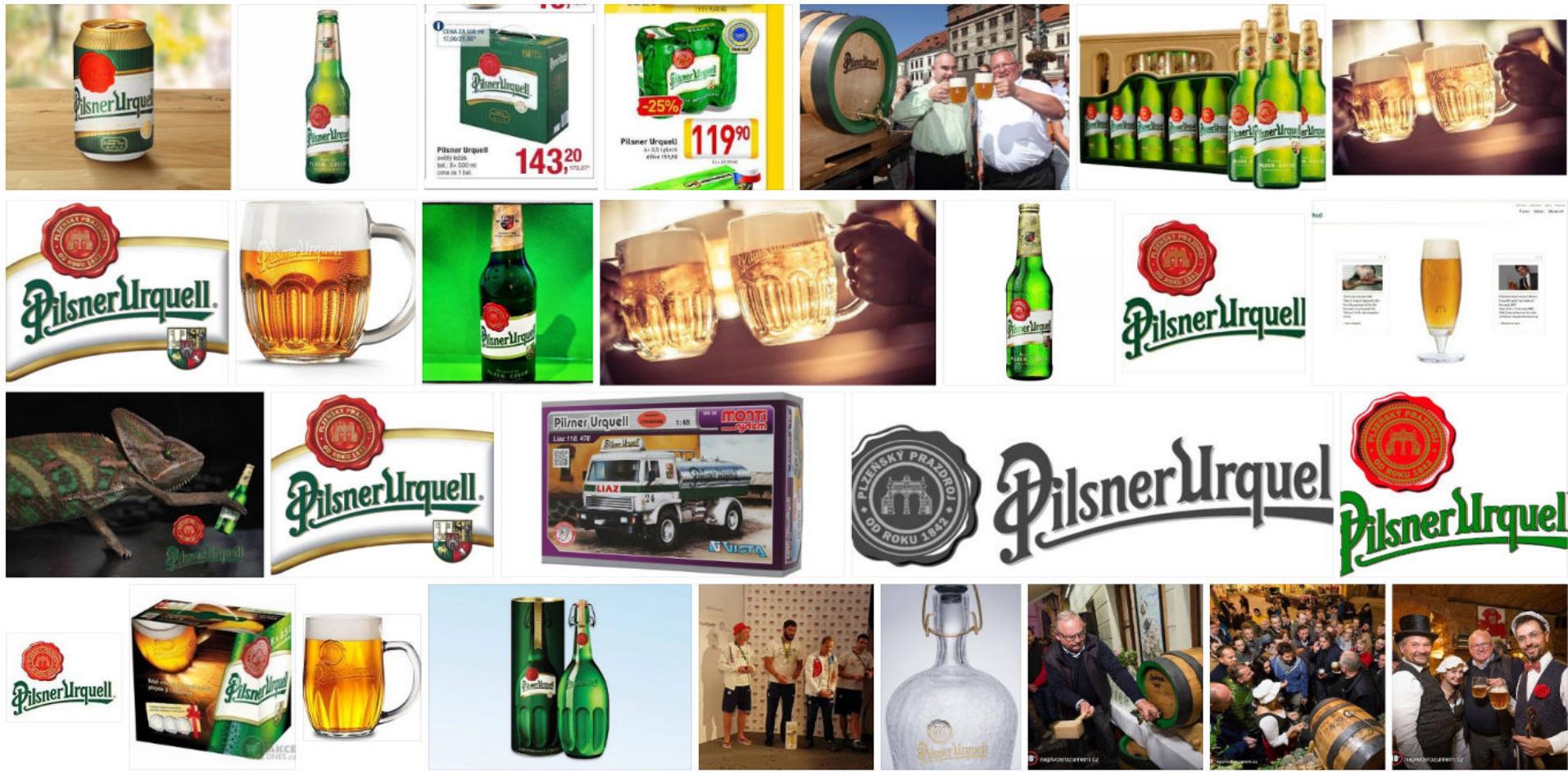
4



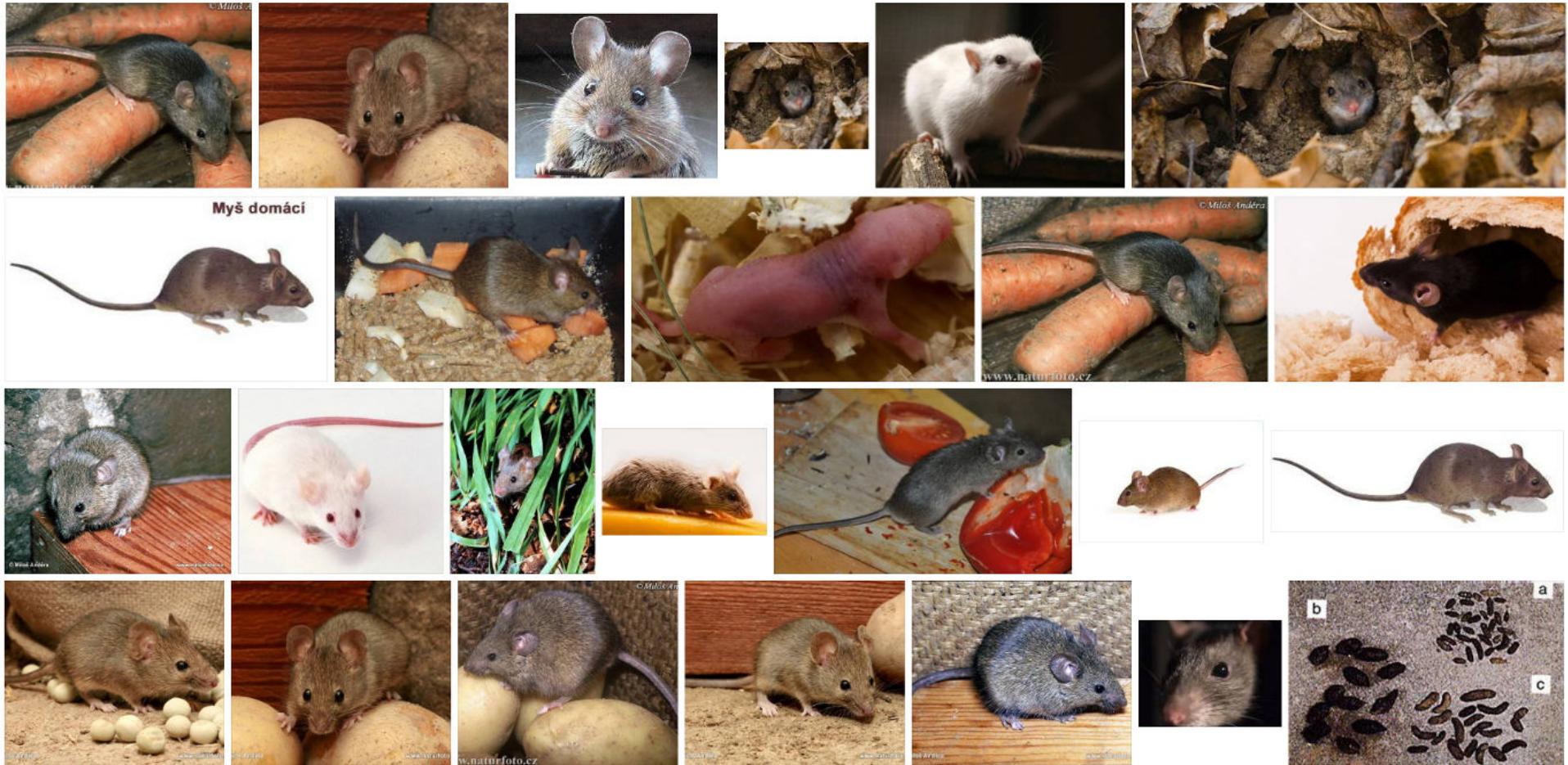
Results



“Pilsner Urquell”



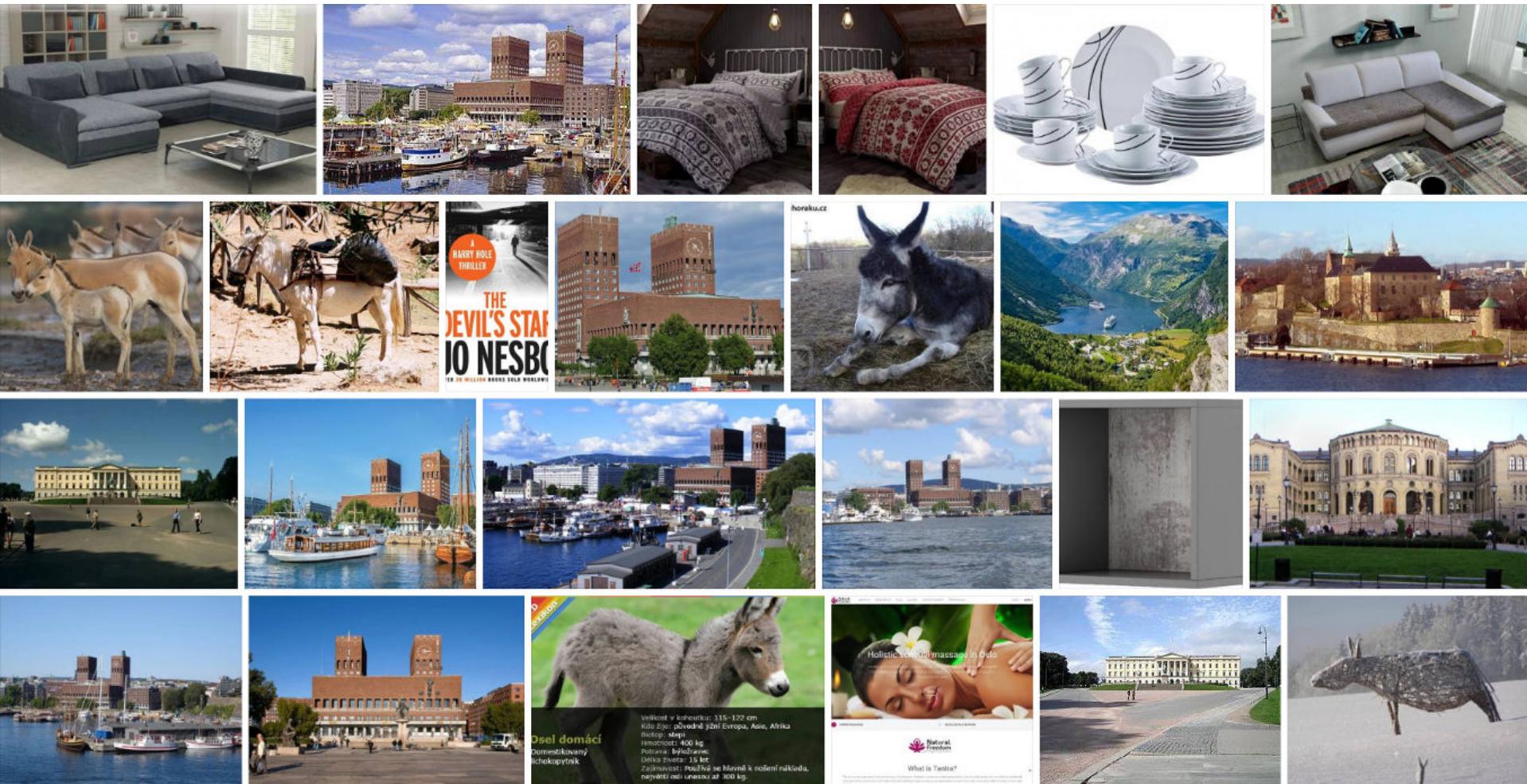
“house mouse”



“mouse”



“Oslo” (~ donkey in czech)



“Prague”



KAMENNÁ
PRODEJNA V PRAZE

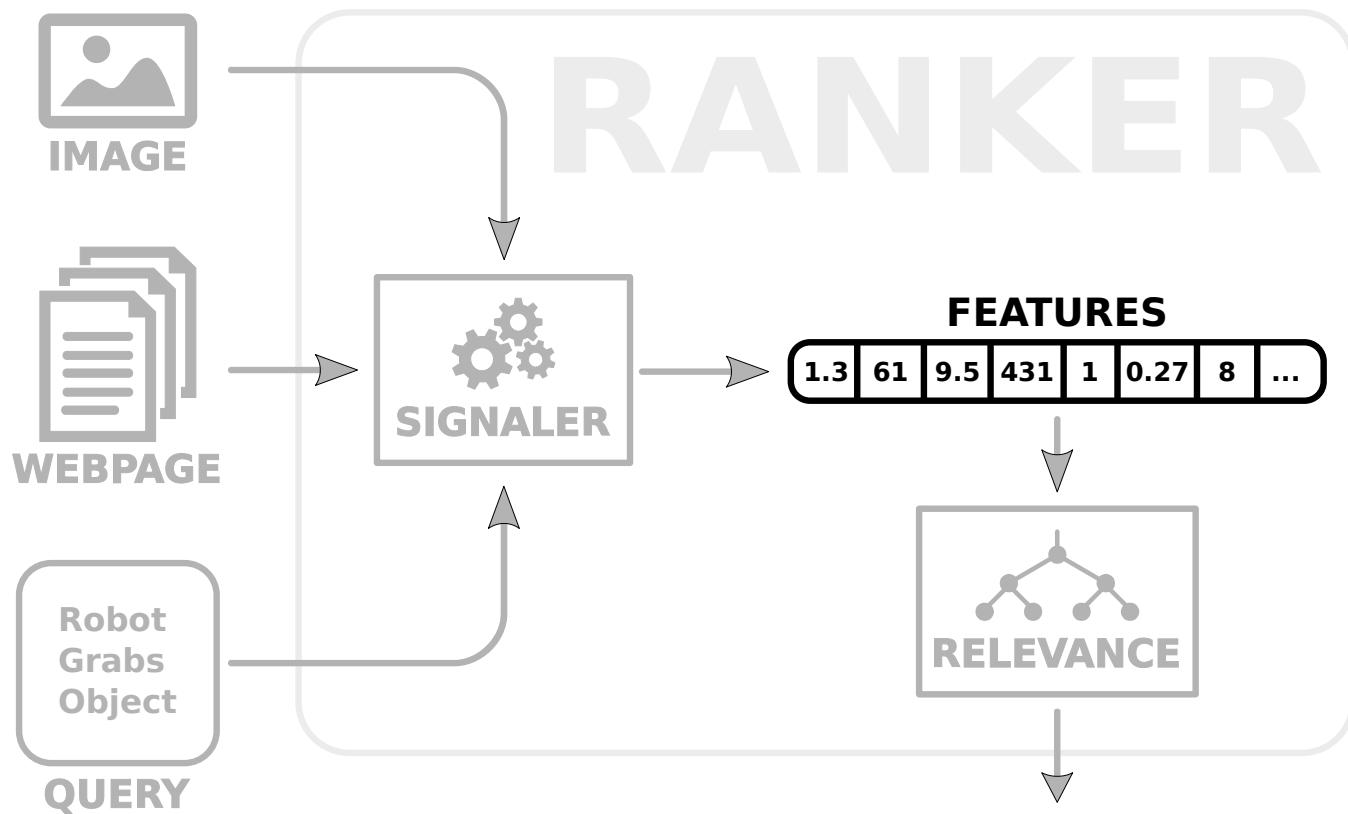


WOW
Black Light Theater

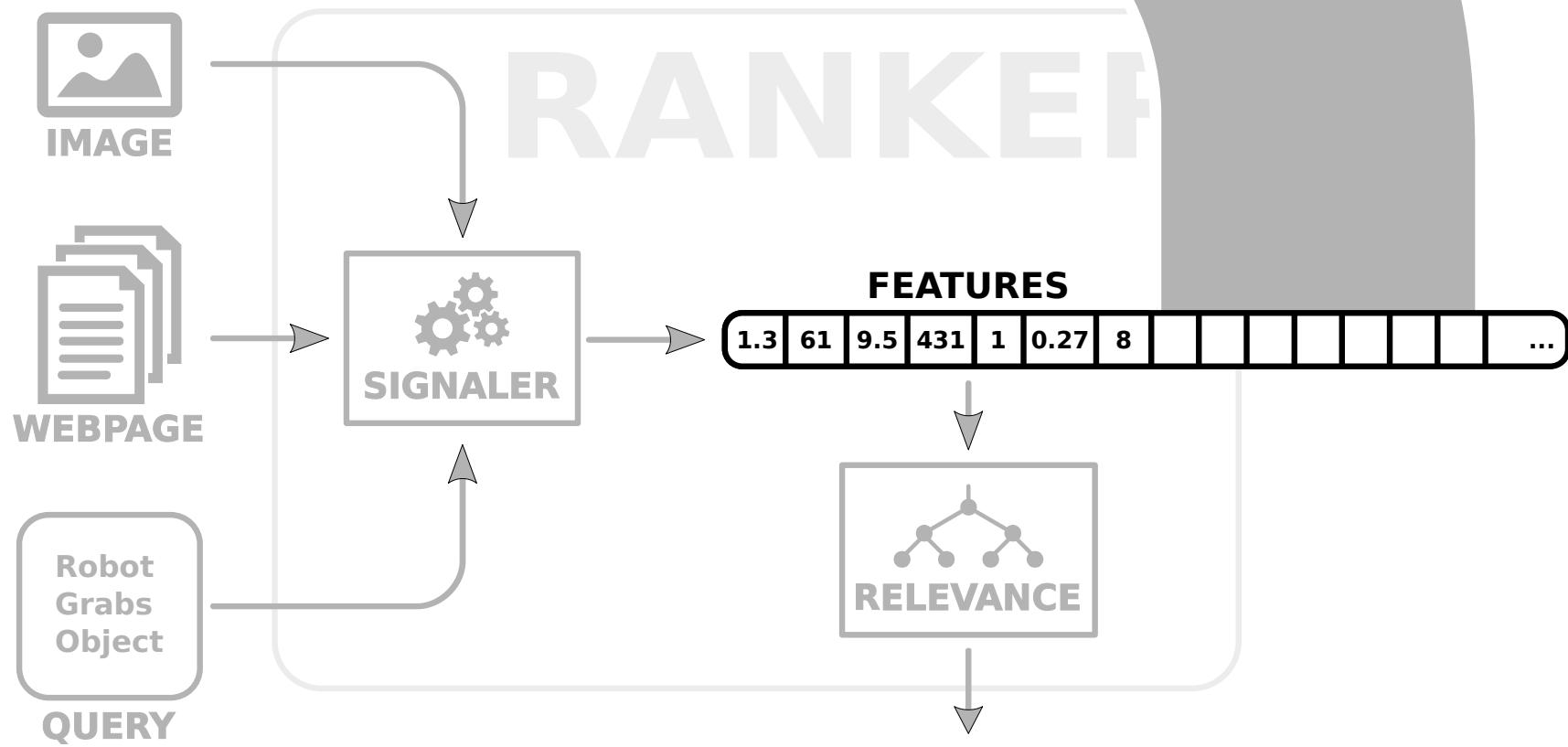


User Feedback





**USER CLICKS
USER SCROLLS
REFORMULATES QUERY**



“Prague” before



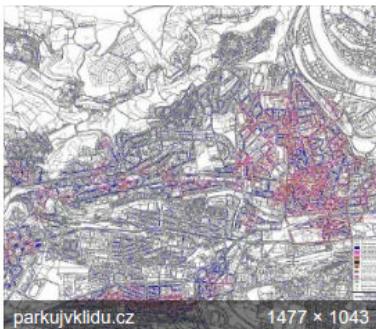
KAMENNÁ
PRODEJNA V PRAZE



WOW
Black Light Theater



“Prague” after feedback



“Prague” on Google



2017- Image Understanding



 **Fotbal**



QUERY SEMANTIC VECTOR



SIMILARITY

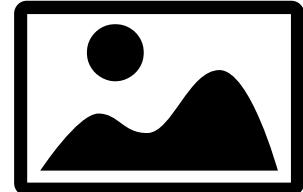


IMAGE SEMANTIC VECTOR

0.78

The quick brown fox jumps over the lazy dog

context

The **quick** brown **fox** jumps over the lazy dog

quick

fox

piano

jumps

brown

lazy

over

tractor

(300 dimensions)

Closest Words

car:

vehicle
cars
SUV
minivan
truck
jeep

house:

houses
bungalow
apartment
bedroom
townhouse
residence

seven:

eight
five
six
four
nine
three

blue:

red
purple
white
maroon
colored
orange

 **Fotbal**



QUERY SEMANTIC VECTOR

SIMILARITY

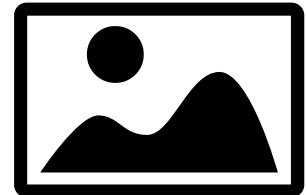


IMAGE SEMANTIC VECTOR



0.78





piano

quick



fox

jumps

brown



lazy

green



over

tractor



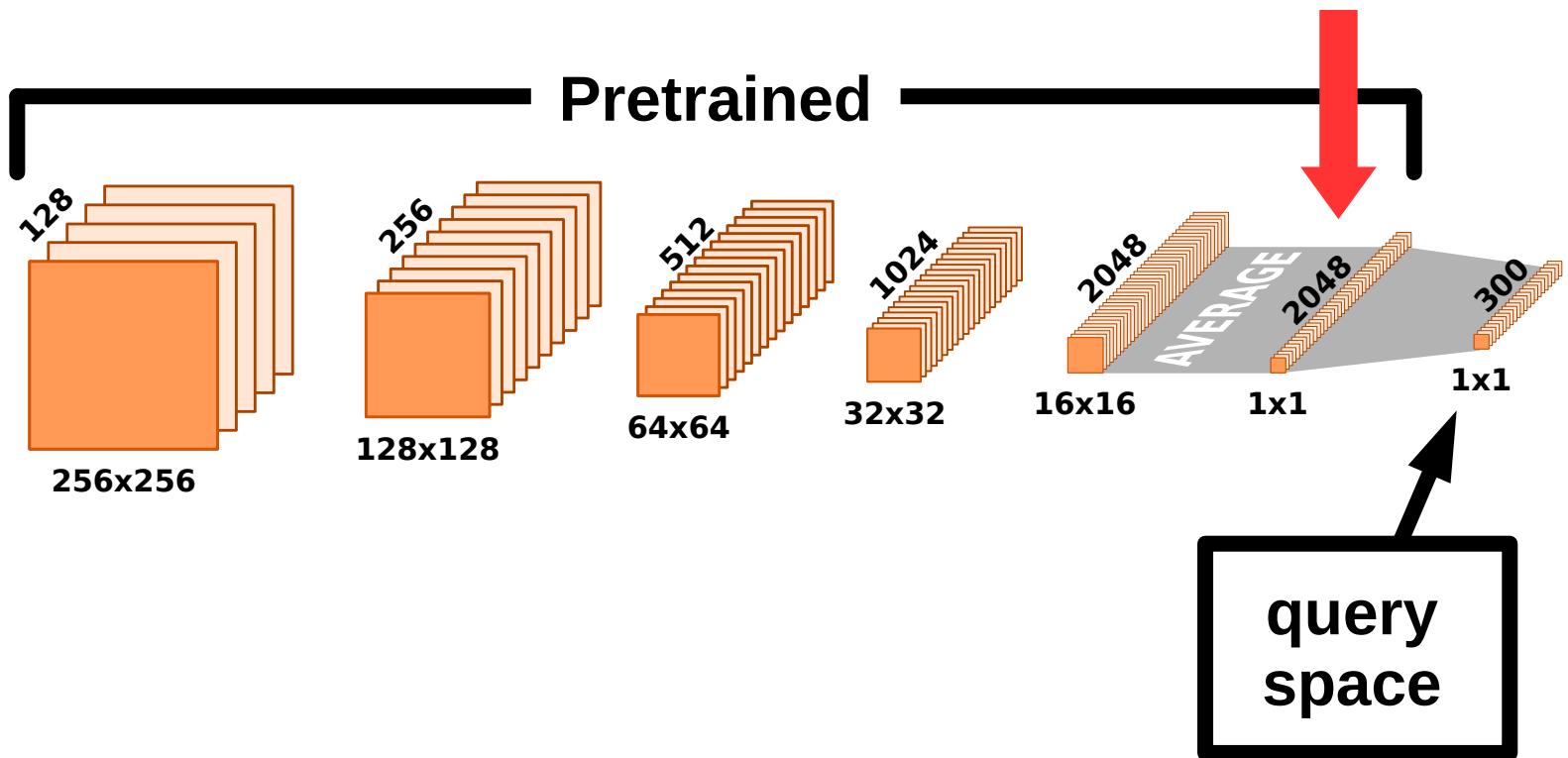
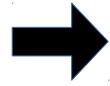
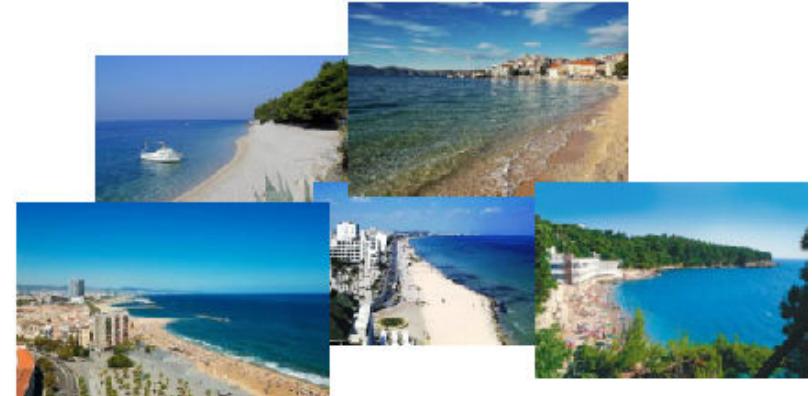
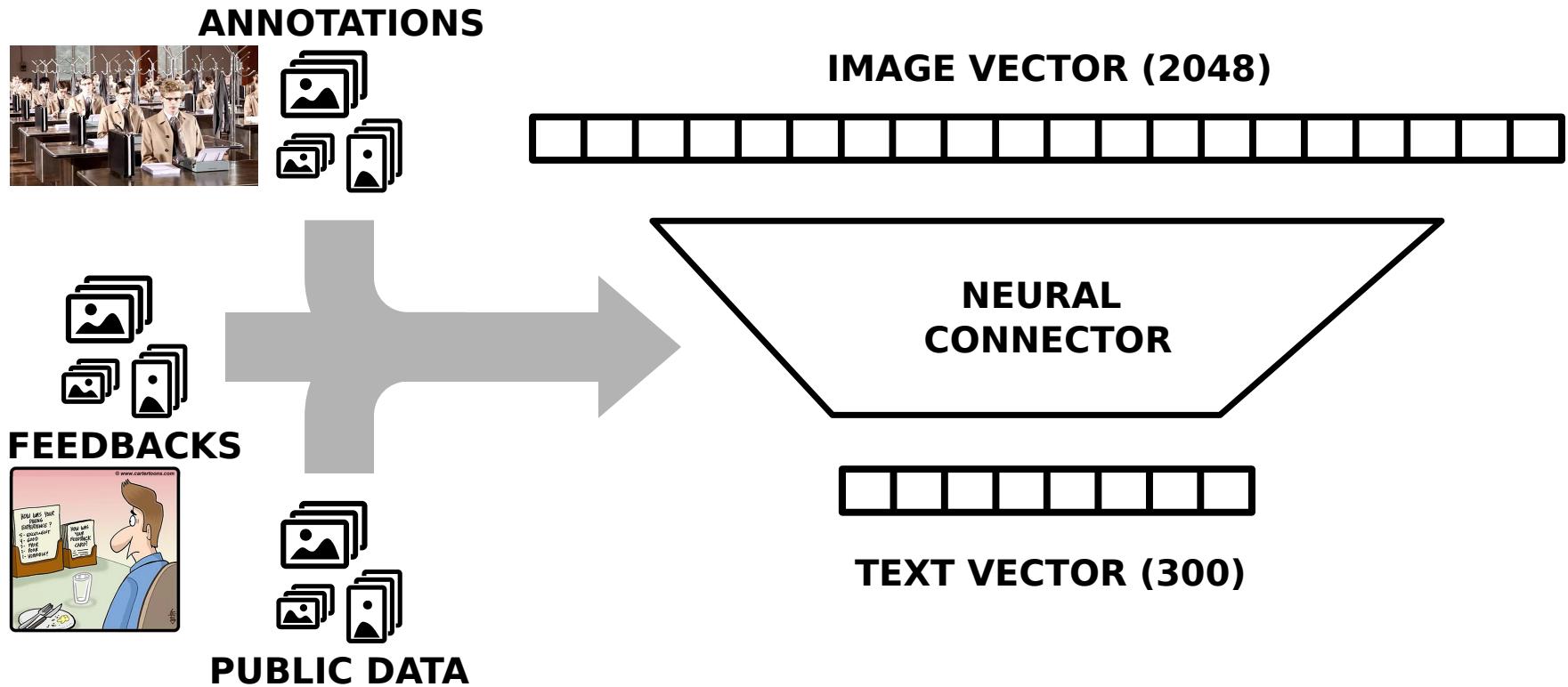


Image vector (2048)





 **Robot**



QUERY SEMANTIC VECTOR



SIMILARITY

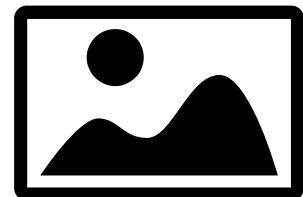
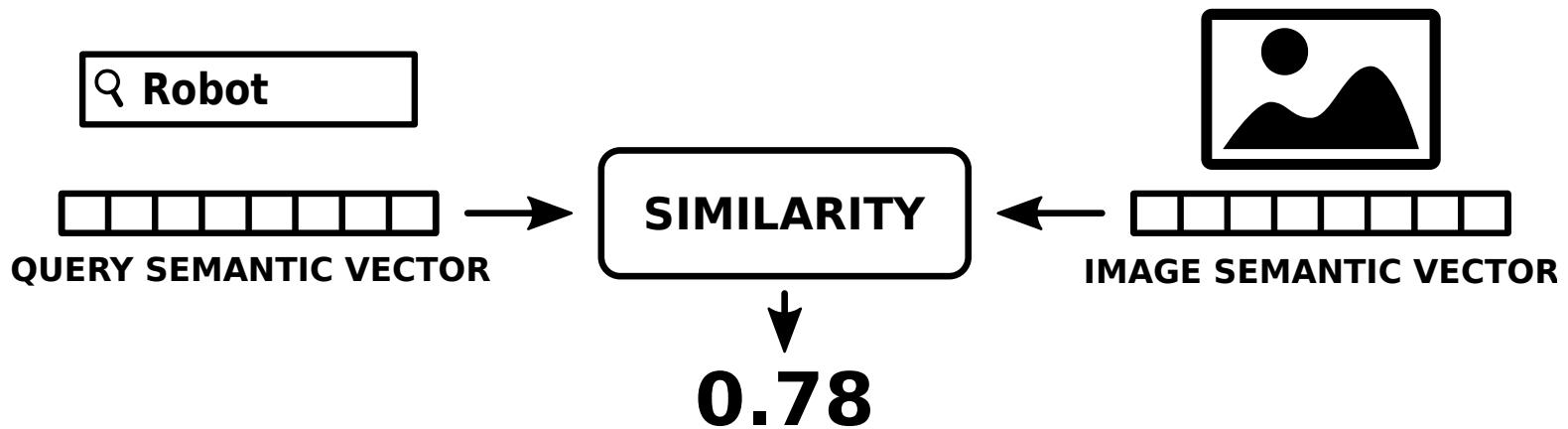


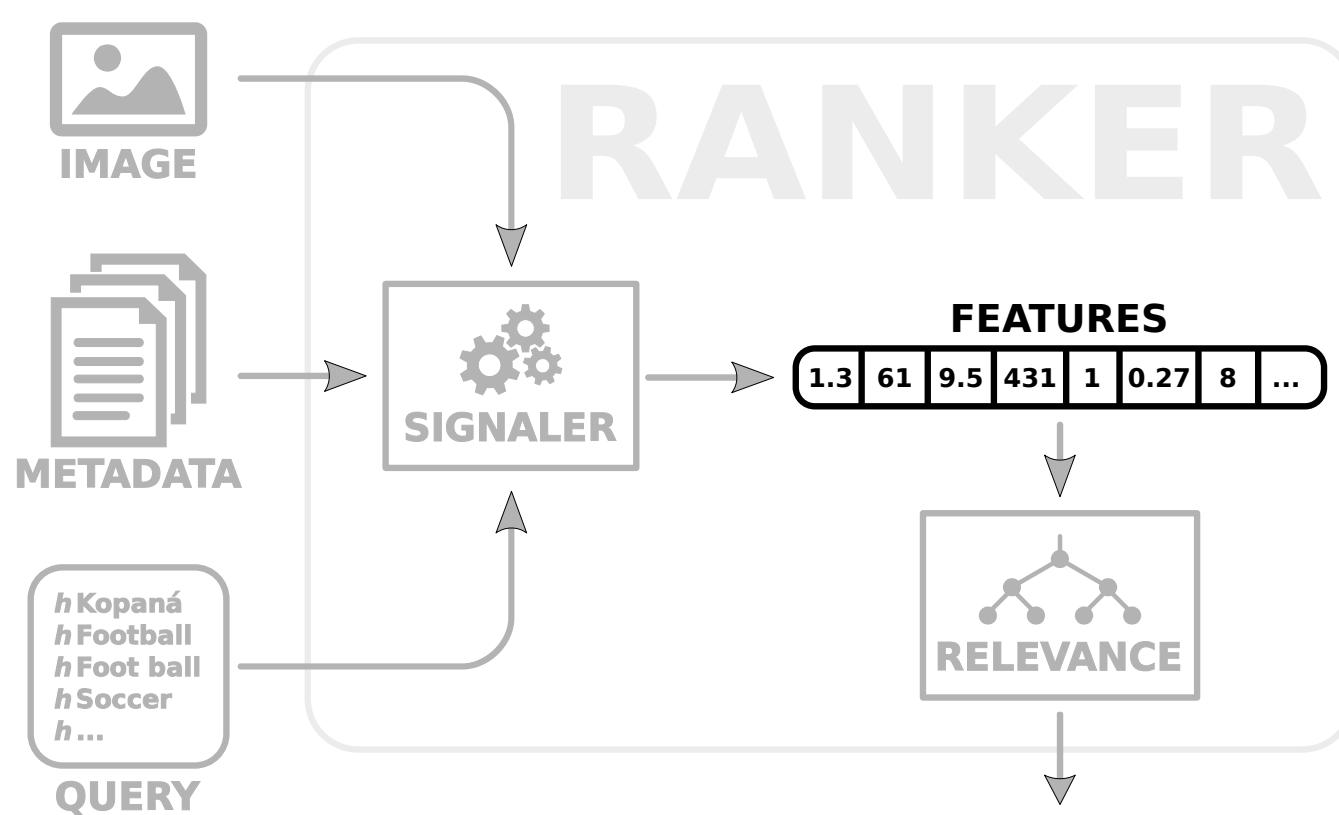
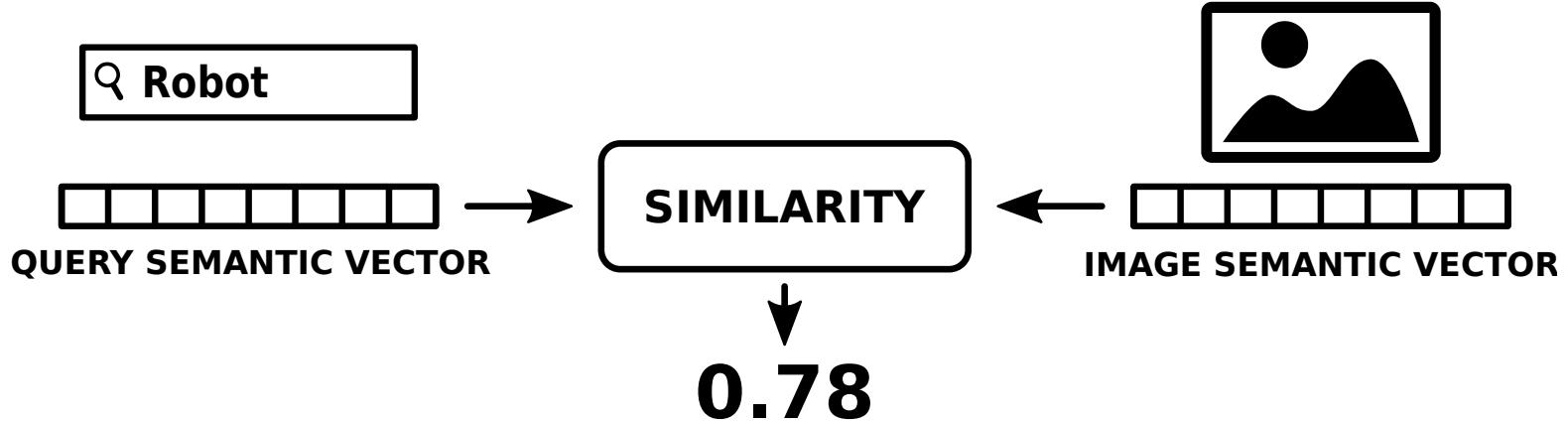
IMAGE SEMANTIC VECTOR

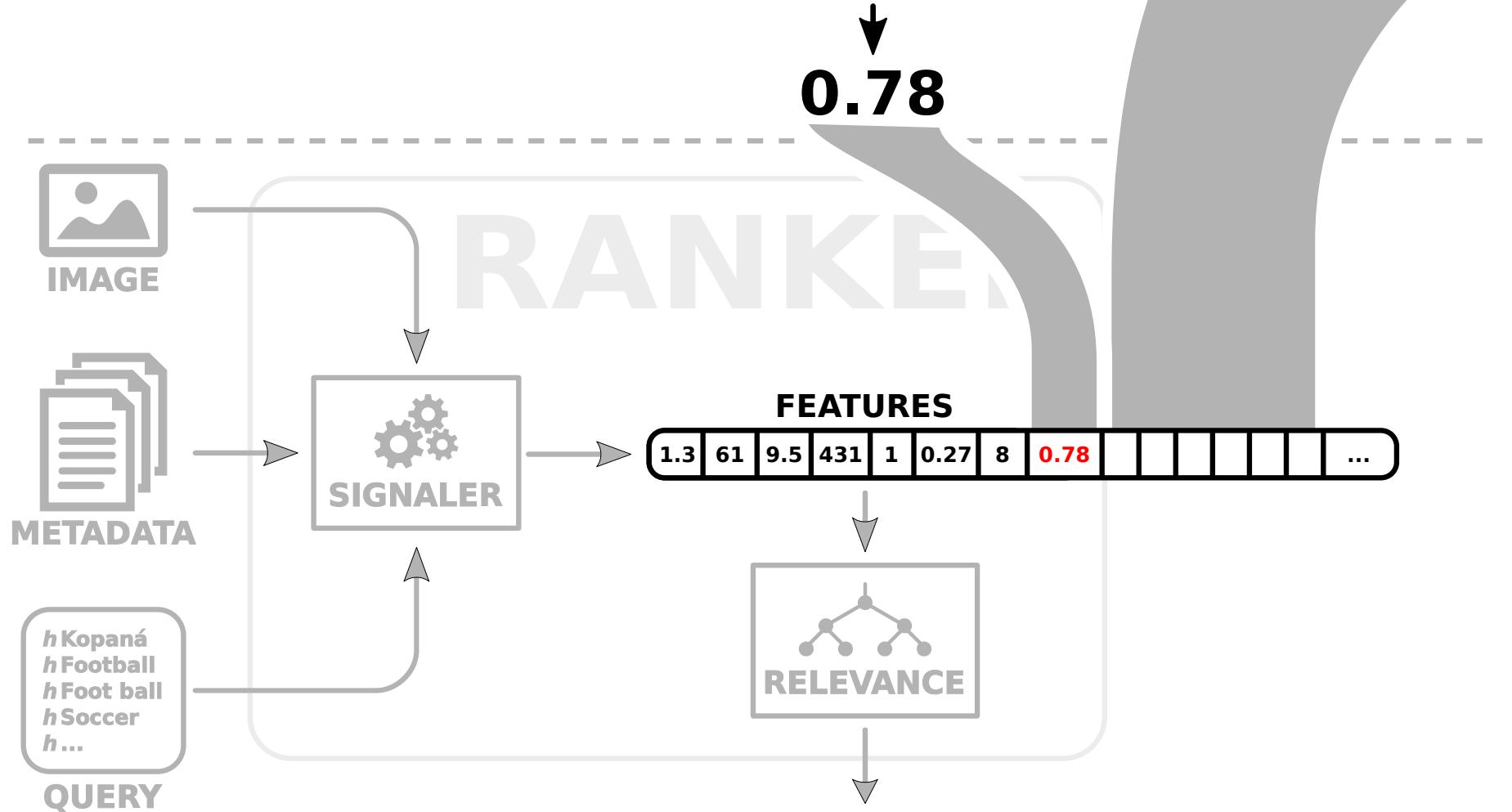


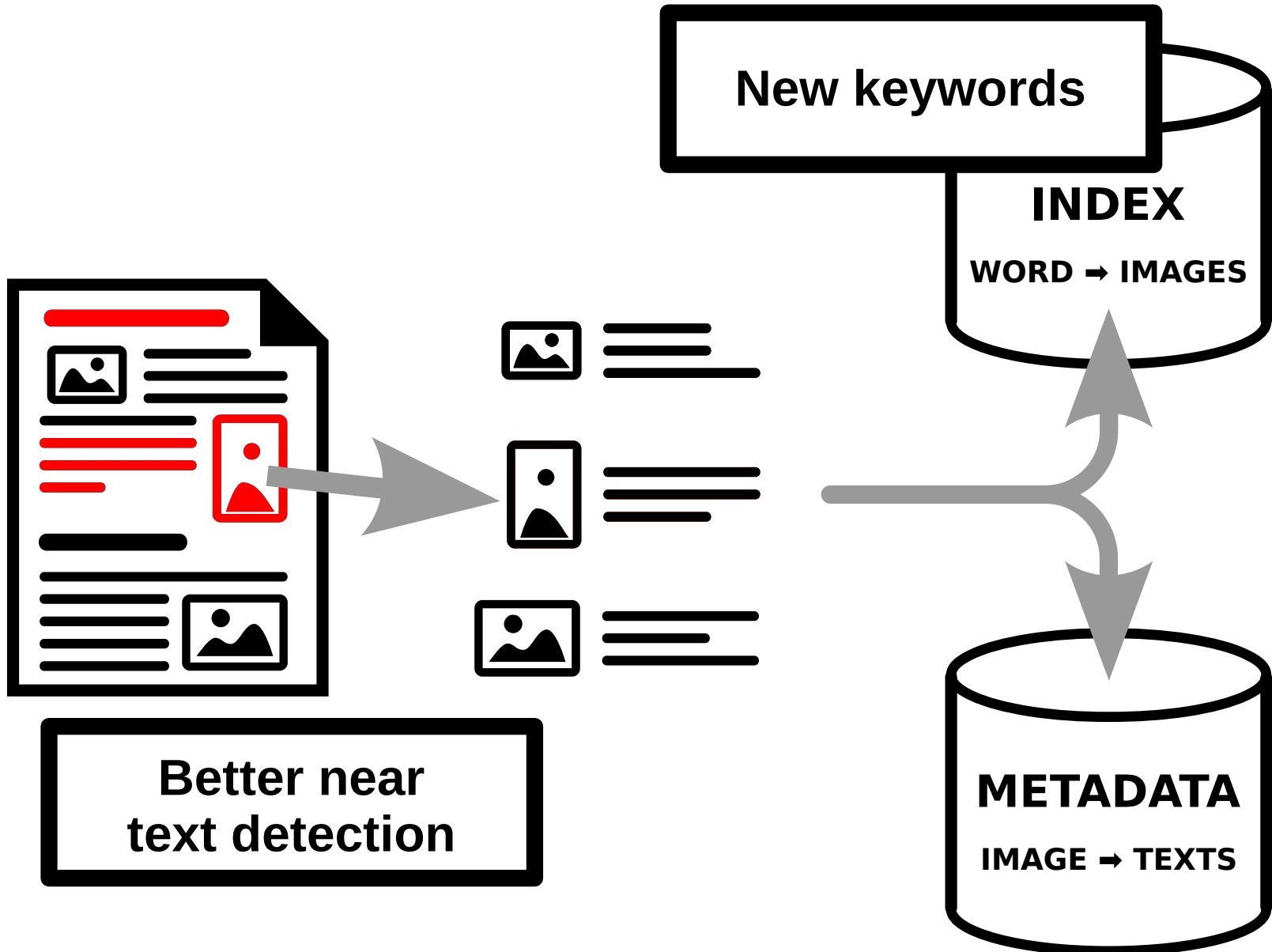
0.78









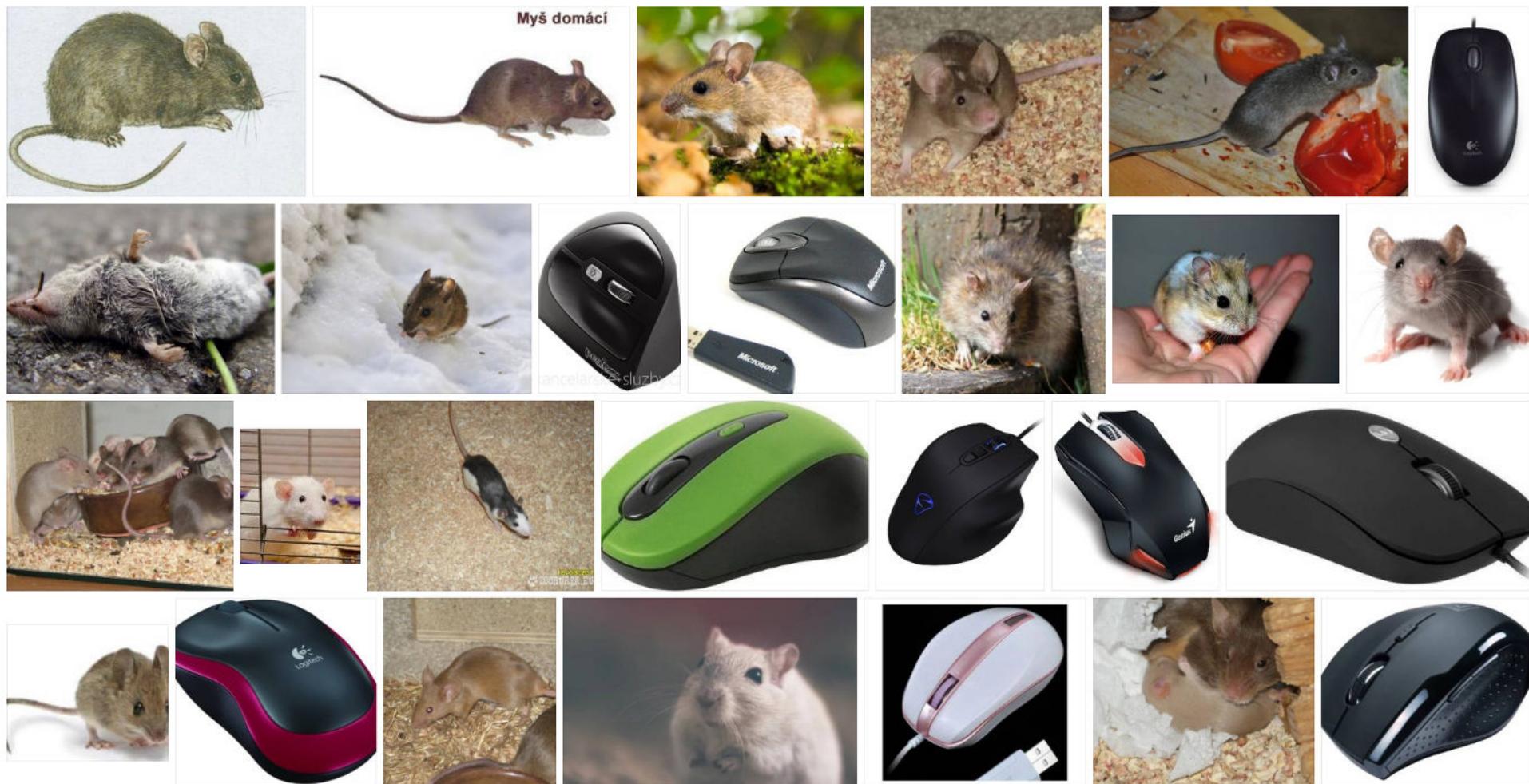


Effect of Neural Networks

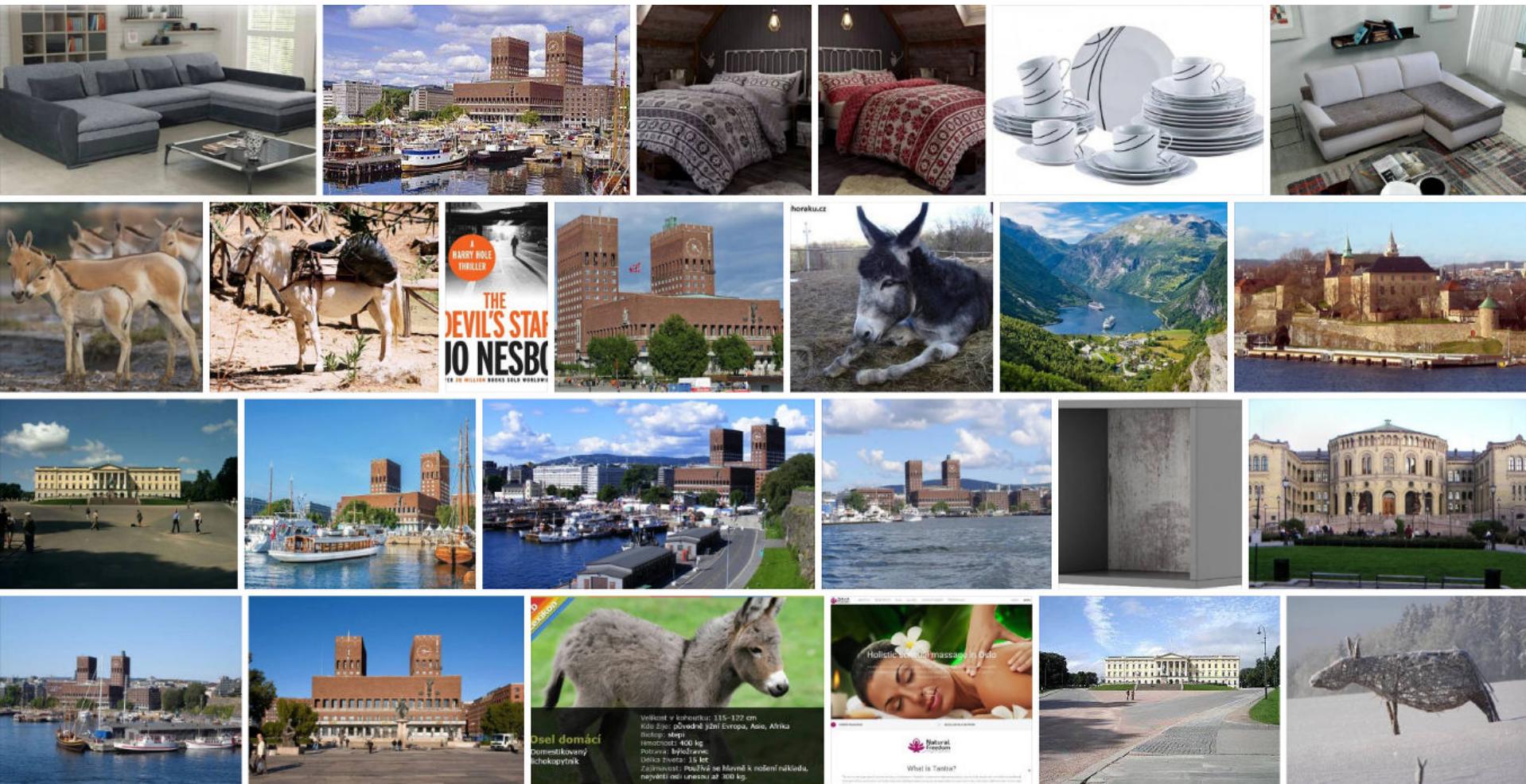
“mouse” old



“mouse” new



“Oslo” old



“Oslo” new

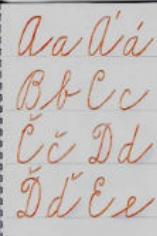


“alphabet” old

Arabic alphabet						نحوه المهجأ العربي					
Meno	Název	Výslovnost	Písmeno	Název	Výslov	م	نـوـهـ	مـهـجـأـ	الـعـبـرـيـ	الـجـاهـ	الـمـهـجـأـ
A a	a	/æ/	N n	en	/ɛn/	ا	نـوـهـ	مـهـجـأـ	الـعـبـرـيـ	الـجـاهـ	الـمـهـجـأـ
B b	bee	/bi:/	O o	/ou/	i	ا	اـلـهـ	دـادـ	تـهـ	تـهـ	دـادـ
C c	cee	/si:/	P p	pee	/pi:/	بـ	بـهـ	دـهـ	تـهـ	تـهـ	دـهـ
D d	dee	/di:/	Q q	cue	/ku:/	تـ	تـهـ	ـهـ	ـهـ	ـهـ	ـهـ
E e	e	/i:/	R r	ar	/ɑ:/	ثـ	ثـهـ	ـهـ	ـهـ	ـهـ	ـهـ
F f	ef	/ɛf/	S s	ess	/ɛs/	هـ	هـهـ	ـهـ	ـهـ	ـهـ	ـهـ
G g	gee	/dʒi:/	T t	tee	/ti:/	كـ	كـهـ	ـهـ	ـهـ	ـهـ	ـهـ
H h	afch	/etʃ/	U u	u	/ju:/	رـ	رـهـ	ـهـ	ـهـ	ـهـ	ـهـ
I i	aye	/aɪ/	V v	vee	/vi:/	ذـ	ذـهـ	ـهـ	ـهـ	ـهـ	ـهـ
J j	jay	/dʒeɪ/	W w	double-u	/dʌblu:/	ظـ	ظـهـ	ـهـ	ـهـ	ـهـ	ـهـ
K k	kay	/keɪ/	X x	ecks	/ɛks/	ـ	ـهـ	ـهـ	ـهـ	ـهـ	ـهـ
L l	el	/ɛl/	Y y	wye	/wʌɪ/	ـ	ـهـ	ـهـ	ـهـ	ـهـ	ـهـ
M m	em	/ɛm/	Z z	zed	/zɛd/	ـ	ـهـ	ـهـ	ـهـ	ـهـ	ـهـ



Mezinárodní jméno	České jméno
Alice	Alžběta
Boris	Borislav
Cecilie	Cecília
Dominik	Dominik
Eduard	Eduard
Ferdinand	Ferdinand
Gerti	Gerti
Hana	Hana
Ivan	Ivan
Jiří	Jiří
Karel	Karel
Lukáš	Lukáš
Martina	Martina
Natalie	Natalie
Ondřej	Ondřej
Petr	Petr
Roman	Roman
Sára	Sára
Tereza	Tereza
Vojtěch	Vojtěch
Wojciech	Wojciech
Zuzana	Zuzana



Ф ў Ѣ Ѧ Ѥ Ѫ
П А Б В Г Д У
Е ё З Ж И І І
Ч Е Ї Я Х

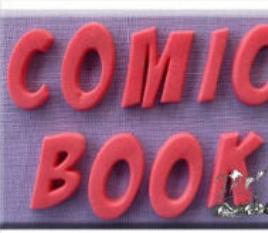


The English Alphabet					
	[əʊ]	J	[dʒeɪ]	S	[es]
B	[beɪ]	K	[keɪ]	T	[tiː]
C	[seɪ]	L	[leɪ]	U	[juː]
D	[deɪ]	M	[meɪ]	V	[viː]
E	[eɪ]	N	[neɪ]	W	[dʌbljuː]
F	[ef]	O	[əʊ]	X	[eks]
G	[dʒeɪ]	P	[piː]	Y	[waɪ]
H	[eʊf]	Q	[keɪ]	Z	[zed]/[zɛs]
I	[aɪ]	R	[er]		



The English Alphabet

meno	Kód	Poemeňajte slovo
A	—	ákuť
B	— ..	býkavice
C	— ..	clovečníci
D	— ..	dálavka
E	.	erb
F	— ..	fípiny
G	— ..	Grécká zem
H	— ..	hrechovina
I	— ..	číhaj na mňava
J	— ..	jas
K	— ..	jasmín bily
L	— ..	krakorá
M	— ..	lupineček
N	— ..	mávila



The English Alphabet			
A [eɪ]	J [dʒeɪ]	S [es]	
B [beɪ]	K [keɪ]	T [teɪ]	
C [seɪ]	L [el]	U [ju:]	
D [deɪ]	M [em]	V [vi:]	
E [eɪ]	N [en]	W ['dʌlbjʊ:]	
F [ef]	O [eo]	X [eks]	
G [dʒi:]	P [pi:]	Y [waɪ]	
H [eɪtʃ]	Q [kju:]	Z [zed / UZ zɪ:]	
I [aɪ]	R [er]		



“alphabet” new



B b	V v	Ø Ø	Ö ö	v	V v
ß w	w w	W W	W w	ƿ w	W w
X x	X x	X X	X x	X g	X x
Y y	Y y	Y Y	Y y	Y y	Y y
Z z	Z z	Z Z	Z z	Z j	Z z
Ä ä	Ã ã	Ã Ã	Ã ä	ä ä	Ä ä
Ö ö	Ӯ ö	Ӯ ö	Ӯ ö	ö ö	Ӯ ö
Ü ü	Ӱ ü	Ӱ ü	Ӱ ü	ü ü	Ӱ ü



Miejski skarbca - Działki w Wyspie.	
4	A
5	B
6	C
7	D
8	E
9	F
10	G
11	H
12	I
13	J
14	K
15	L
16	M
17	N



Das deutsche Alphabet



Aa Áá
Bb Cc
Čč Đđ
Đđ Ěě



A	Á	B	b	C	C	Č	D	D	D	E	É	É
á	douhá	bé	cé	čé	dé	dé	é	douhé	e	náhén	e	néhén
[a:]	[a:]	[b]	[b]	[c:]	[c:]	[č:]	[d]	[d:]	[d:]	[e:]	[e:]	[e:,je]
G	H	Ch	ch	I	I	J	K	K	L	M	M	N
g	há	chá	i	douhá	jé	ká	é	em	m	m	m	m
[g]	[h:]	[x]	[x]	[i:]	[i:]	[j:]	[k:]	[l:]	[m]	[n:]	[n]	[n:]
O	Ó	P	p	Q	Q	R	R	S	S	T	T	T
ó	douhá	pé	pé	kvá	kvá	er	er	et	et	té	té	té
[o:]	[o:]	[p:]	[p:]	[kv:]	[kv:]	[r:]	[r:]	[s:]	[s:]	[t:]	[t:]	[t:]
U	Ú	Ú	ú	V	V	W	W	X	Y	Ý	Z	Ž
ú	douhá	ú	ú	vouhá	vouhá	wé	wé	youn	youn	zé	zé	zé
[u:]	[u:]	[u:]	[u:]	[v:]	[v:]	[w:]	[w:]	[y:]	[y:]	[z:]	[z:]	[z:]



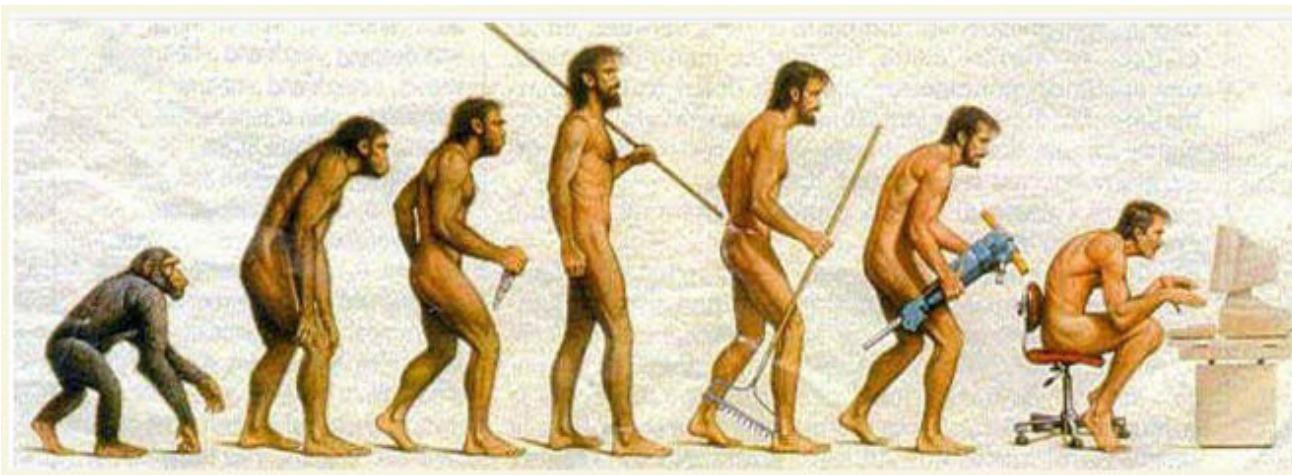
Česká abeceda

a á b c č d ď e é ě
f g h ch i í j k l m
n ň o ó p q r ř s š
t ť u ú ū v w x y ý
z ž

A B C D E F G
H I J K L M N
O P Q R S T U
V W X Y Z

A B C
D E F
G H I

Evolution



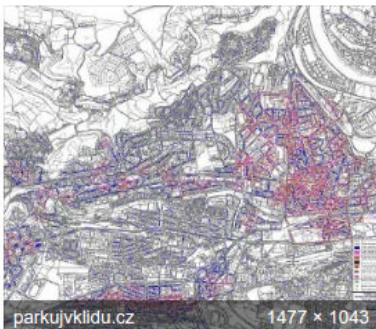
“Prague” - picsearch



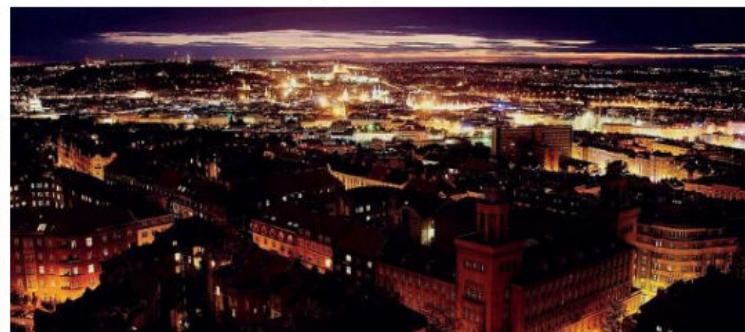
“Prague” - Basic Search



“Prague” - Feedback

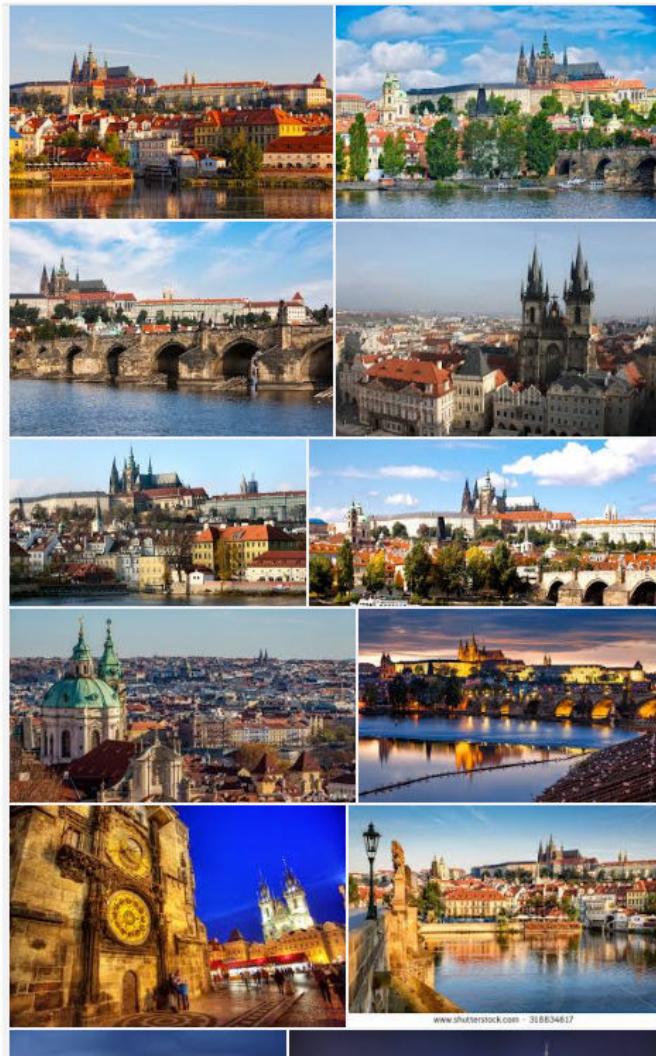


“Prague” - Neural Nets

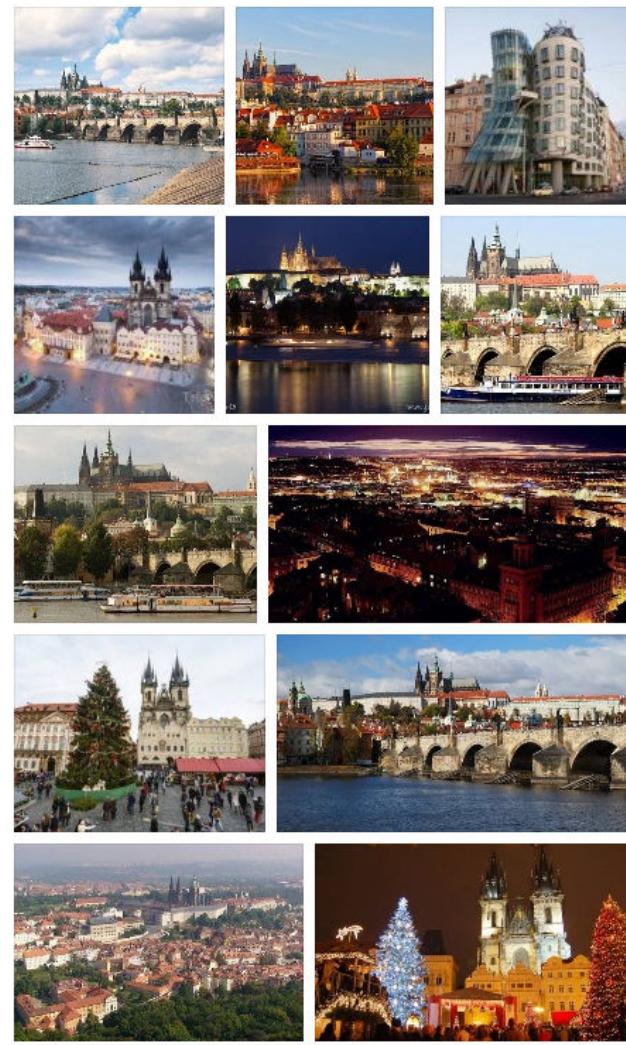


“Prague”

Google



SEZNAME.CZ
Obrázky

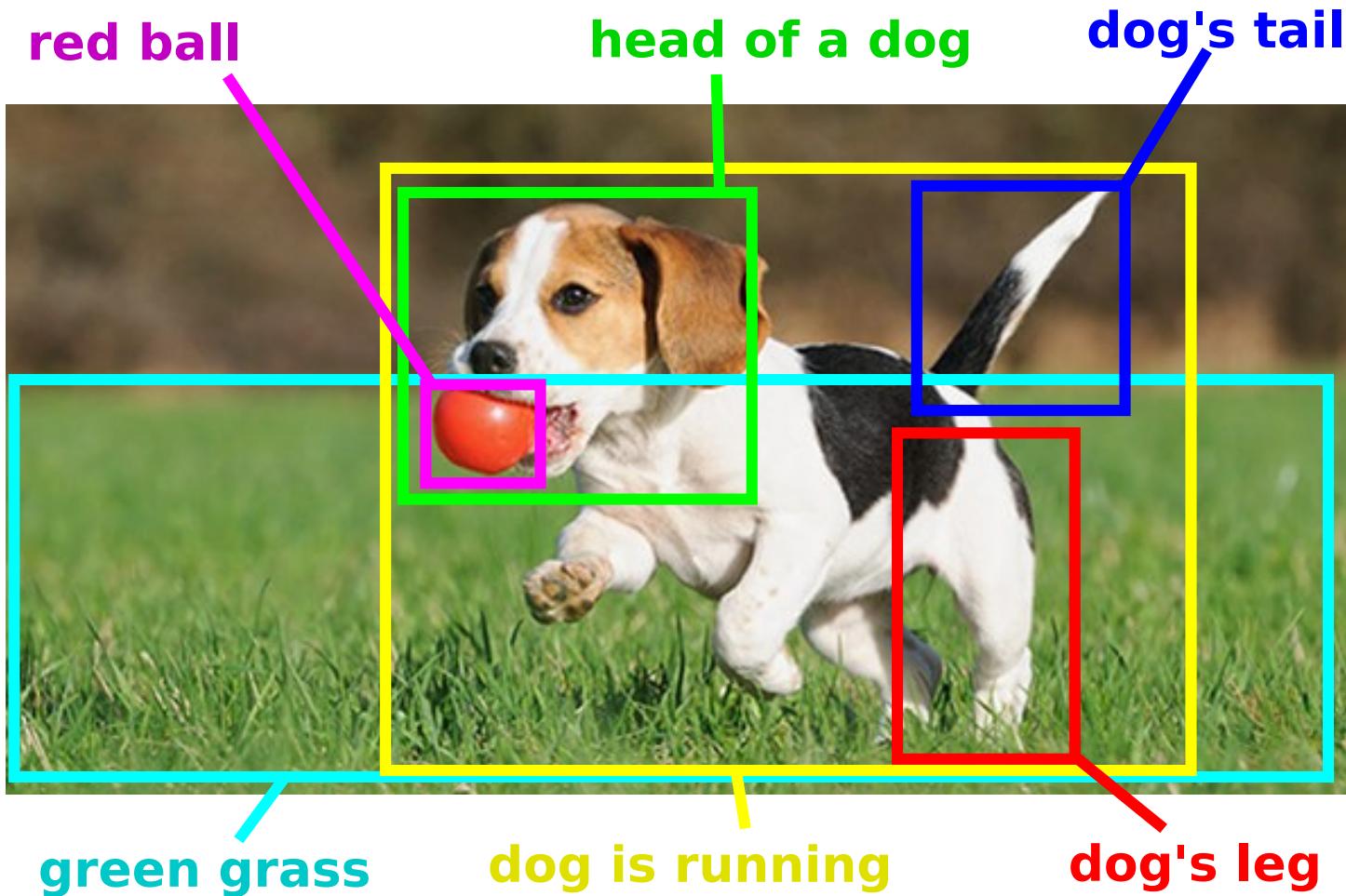


Future

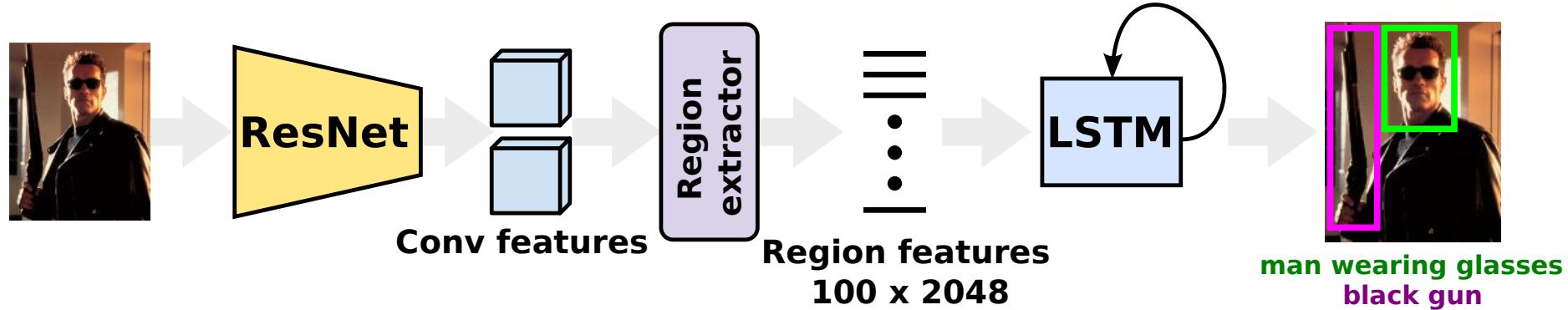


EVANS/THREE LIONS/GETTY IMAGES

Goal



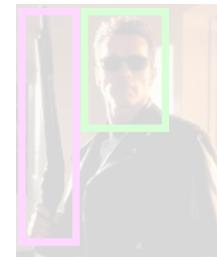
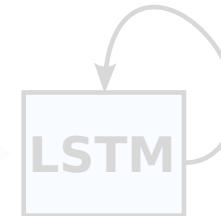
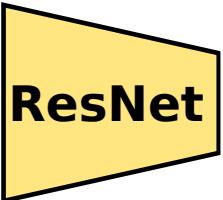
Object Detection Prototype



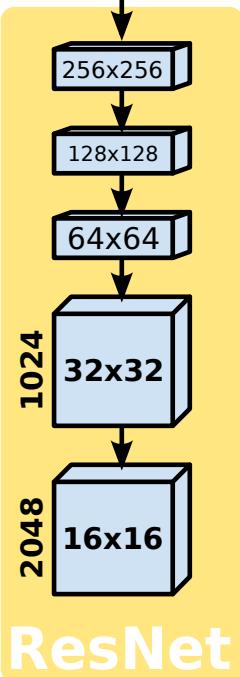
References:

- DenseCap, Faster RCNN, SharpMask
- Visual-Semantic Alignments
- ResNet, Identity Mappings
- Today: Google object detection API

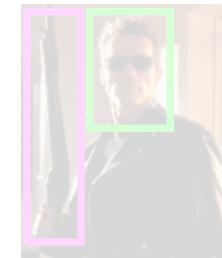
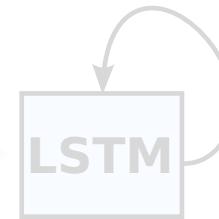
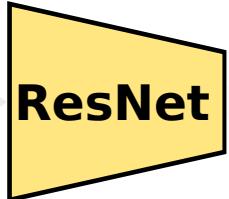
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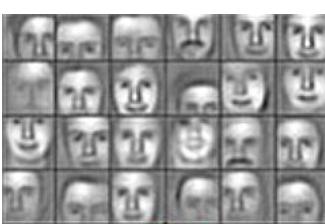
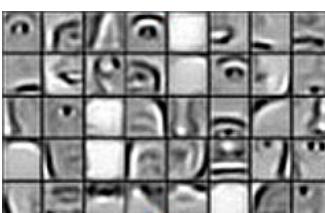
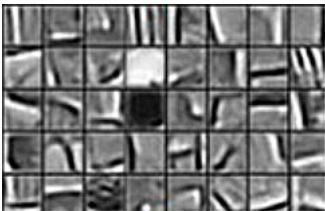
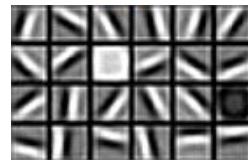
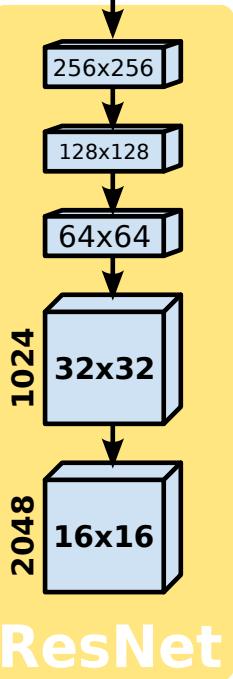
man wearing glasses
black gun



512 x 512 x 3



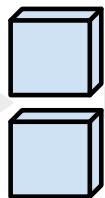
man wearing glasses
black gun



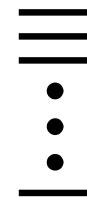
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ResNet



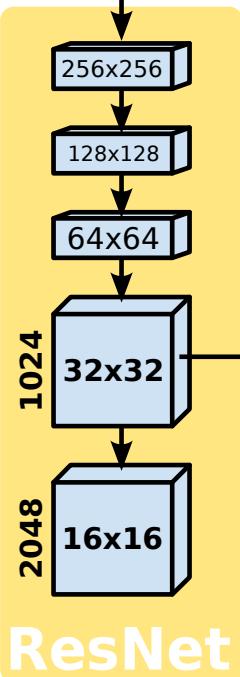
Region extractor



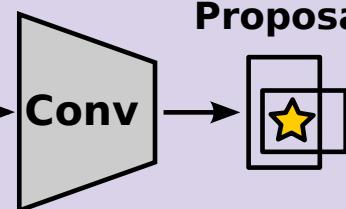
LSTM



man wearing glasses
black gun

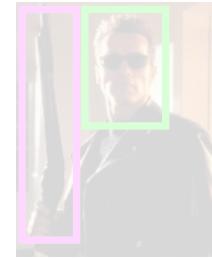
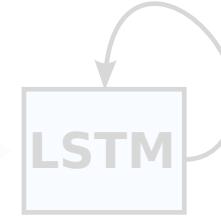
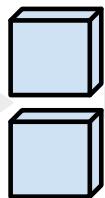
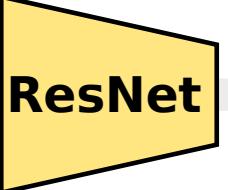


**32 x 32
Region
Proposals**

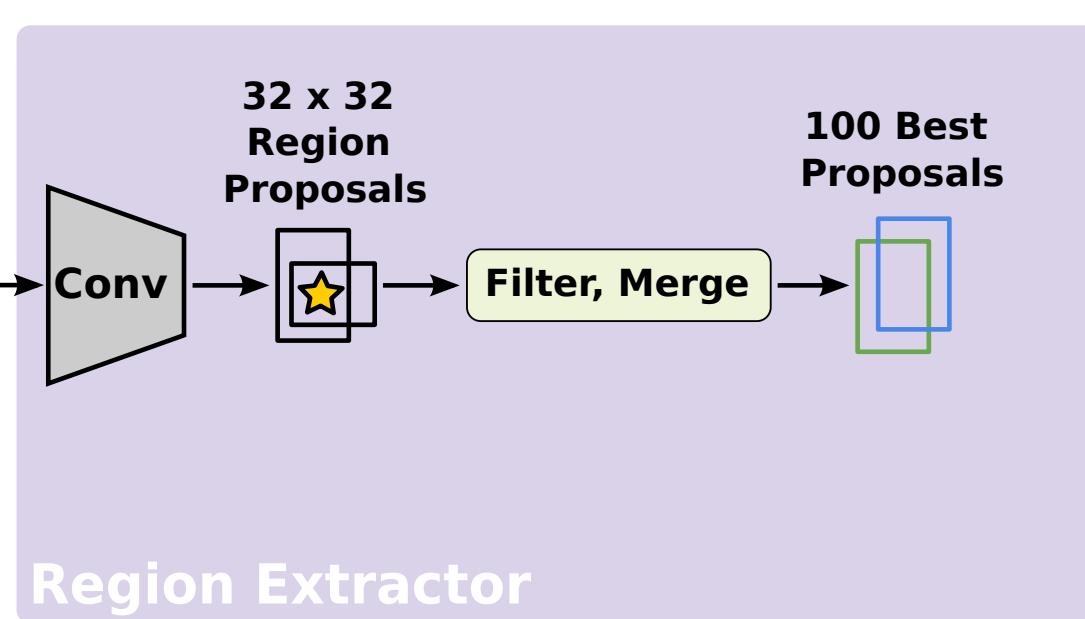
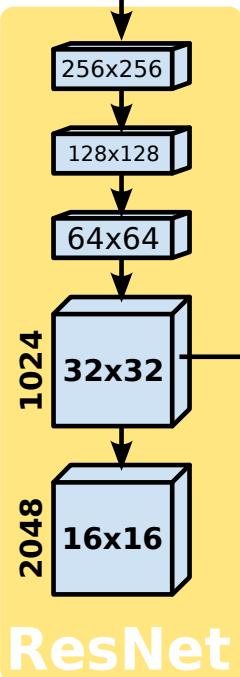


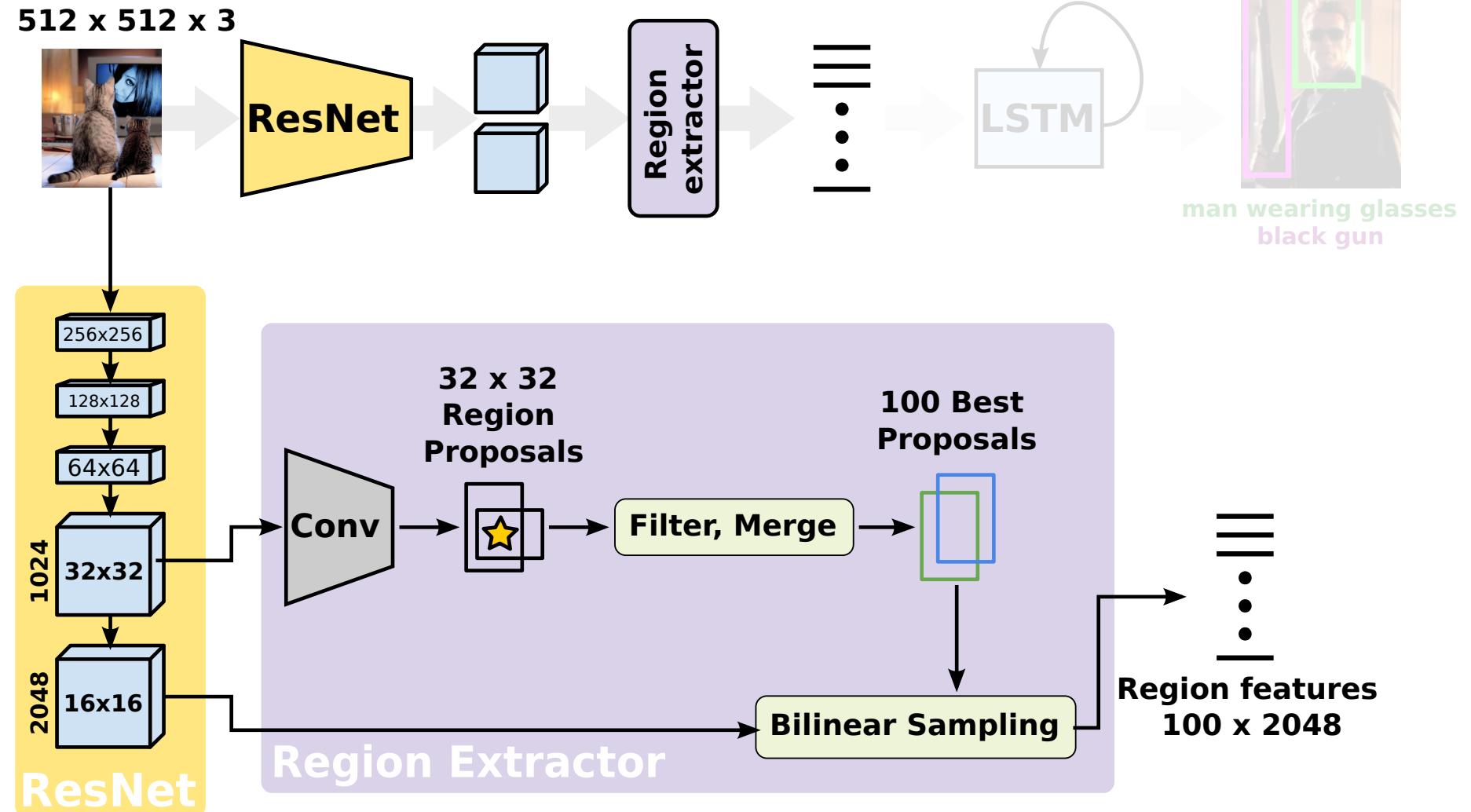
Region Extractor

512 x 512 x 3

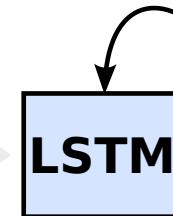
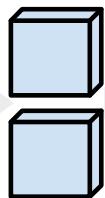


man wearing glasses
black gun

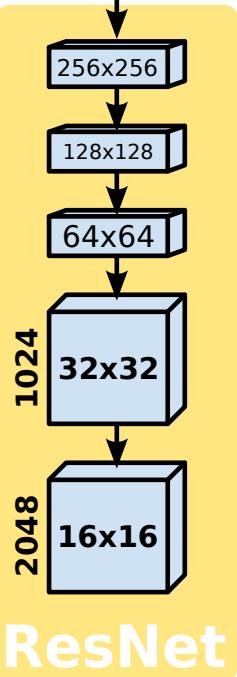




512 x 512 x 3



**man wearing glasses
black gun**



region features

memory vector

LSTM

word

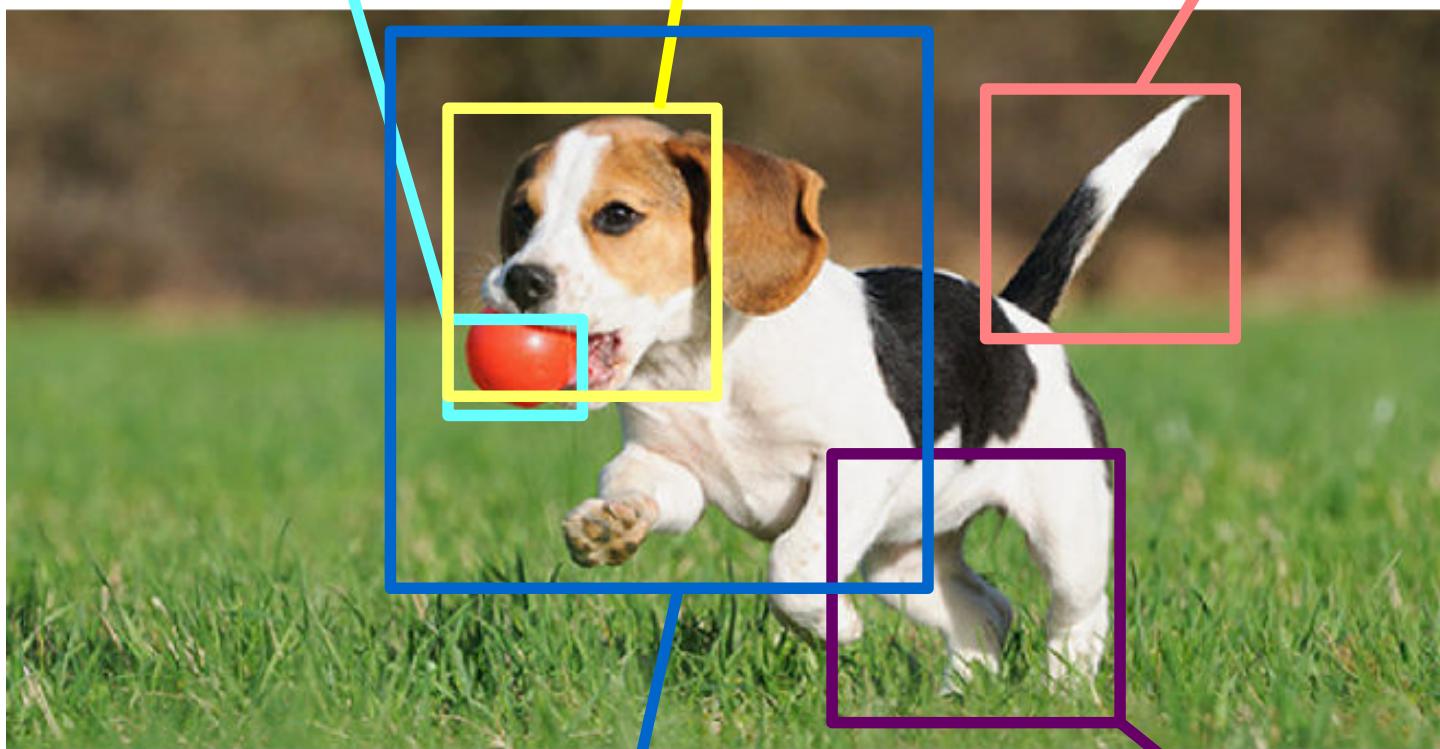
Result

- red frisbee

- red and white apple

- head of a dog

- tail of a bird
- tail of a dog

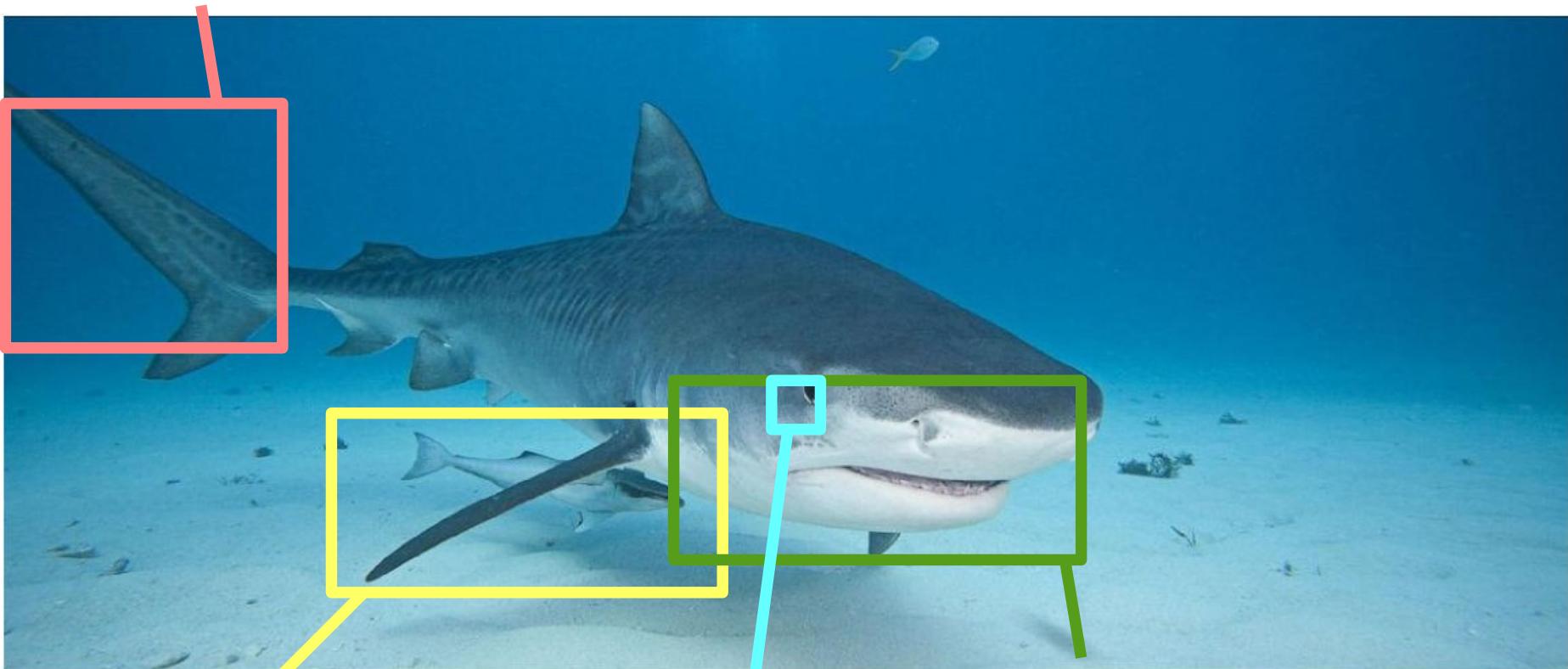


- this is dog
- dog is white and brown

- cow's legs
- sheep legs

Generalization

- this is tail

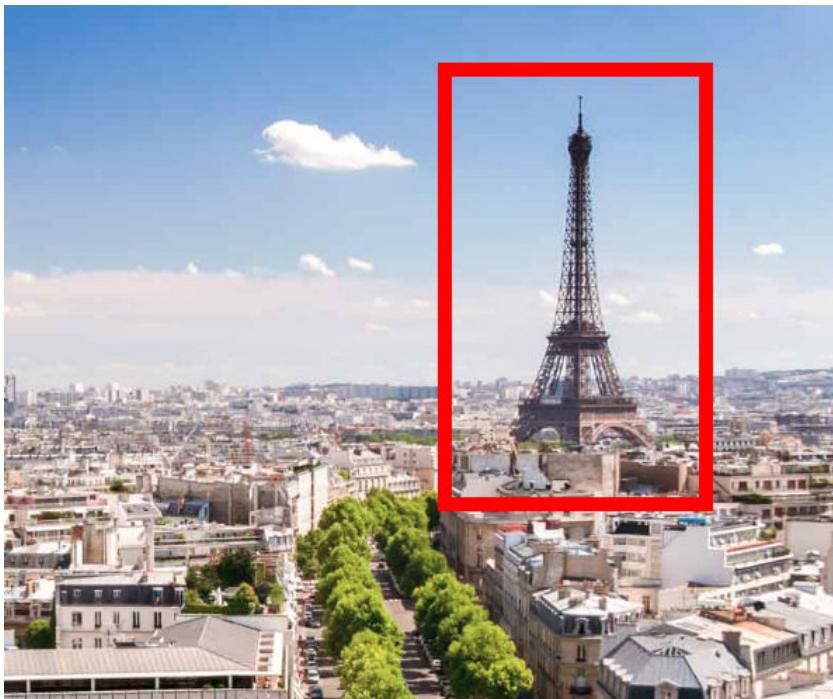


- leg of a person
- bird's leg

- left eye of a bird
- polar bear's eye

- nose of a man
- man wearing white shirt

Landmarks Celebrities



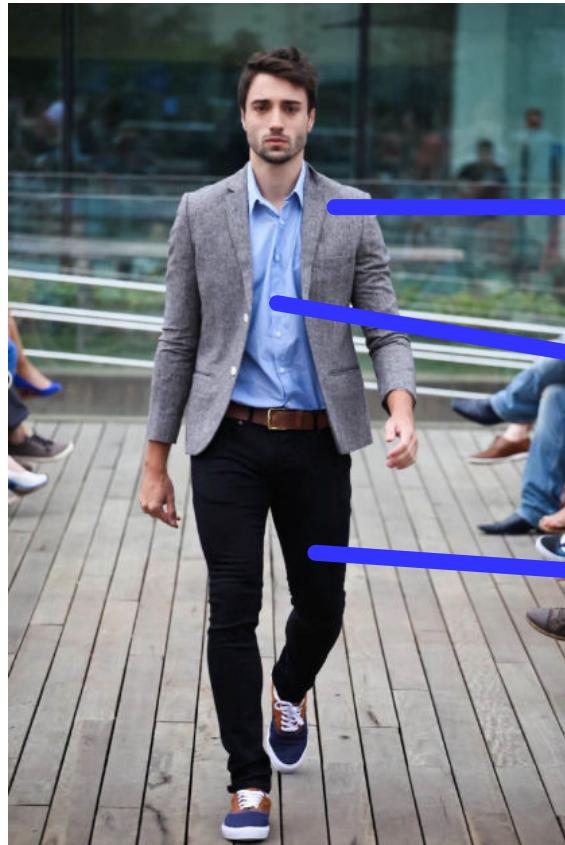
Eiffel Tower



Arnold
Schwarzenegger

Sylvester
Stallone

Shopping



Gray blazer

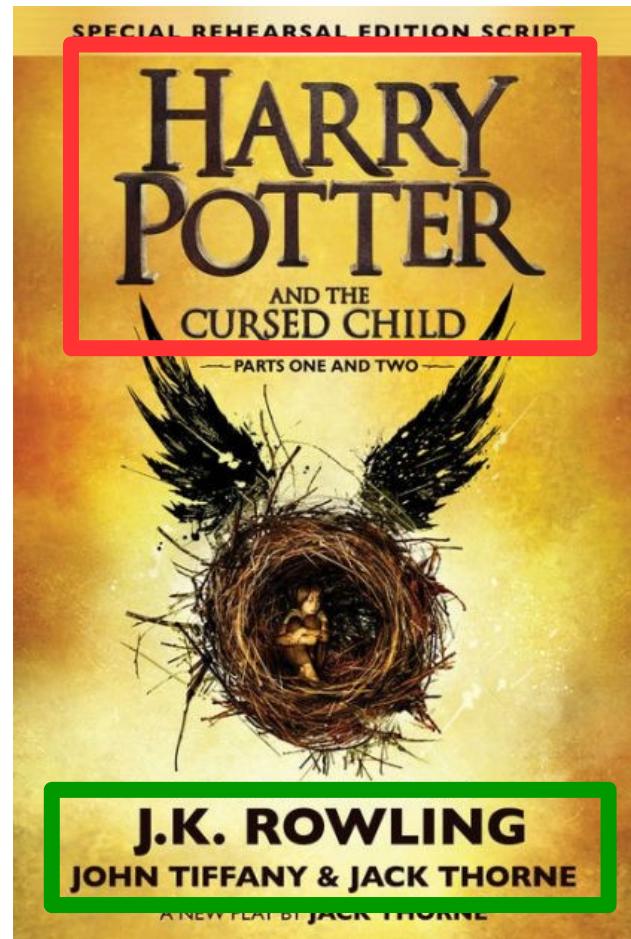
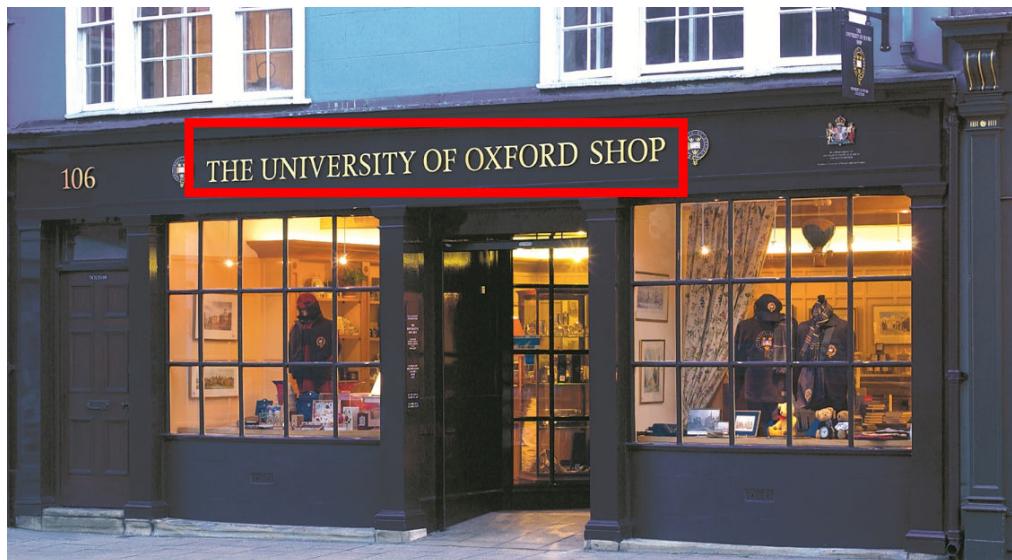


Blue shirt

Black trousers



OCR



Thanks & Questions

