

# Watching the World

**Helmut Grabner**  
helmut.grabner@zhaw.ch

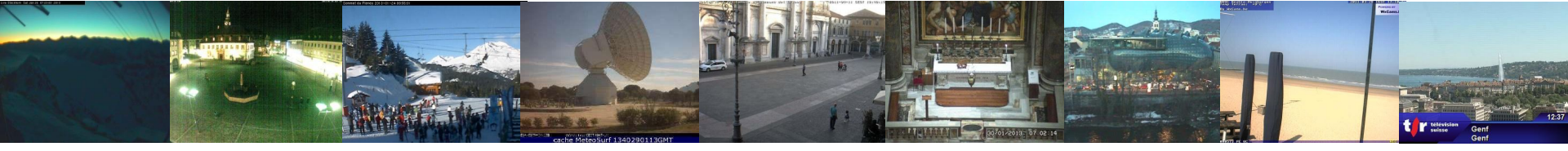
FabLab Winti MakerTalk  
2023/12/08

Zurich University  
of Applied Sciences



**School of  
Engineering**

**Right now, thousands of publicly accessible network cameras are capturing images of the world.**

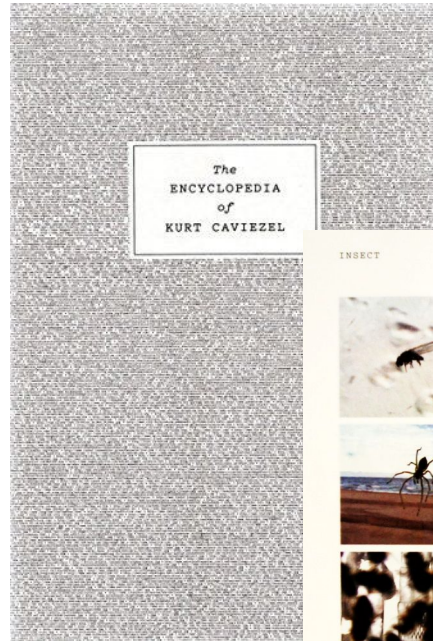


Right now, thousands of publicly accessible network cameras are capturing images of the world.

**Last week, we personally visited four of these cameras.**



## Kurt Caviezel



Right now, thousands of publicly accessible network cameras are capturing images of the world.

Last week, we personally visited four of these cameras.

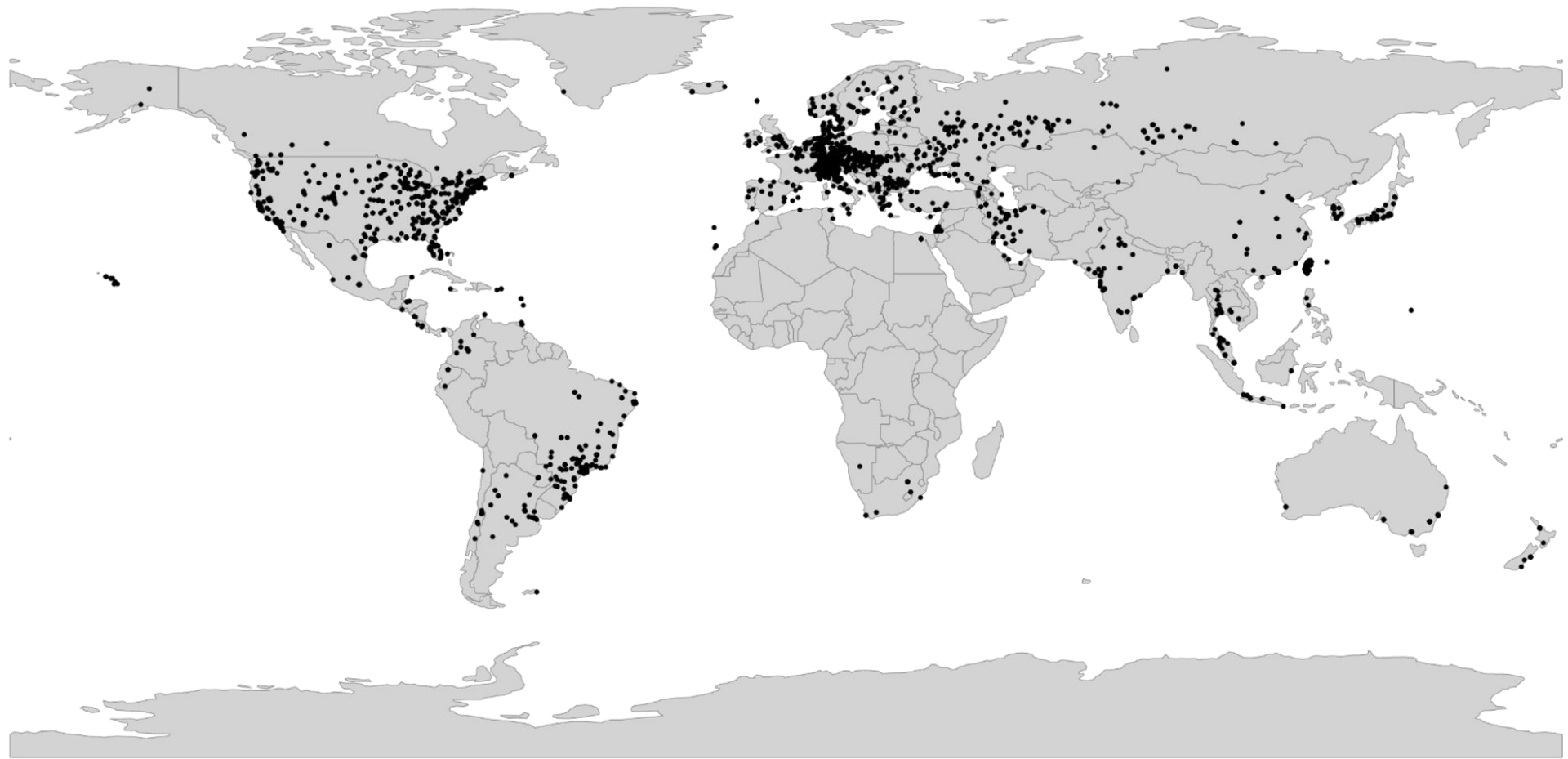
**It was an exciting, inspiring, and highly creative 'traveling' team retreat across Switzerland, part of the art-meets-science project: Watching the World.**

WATCHING THE WORLD is an art,  
photography, AI, and big data project that  
utilizes global open data sources.

# WATCHING THE WORLD

– Analysis of 14,363 (and counting) Netcams –

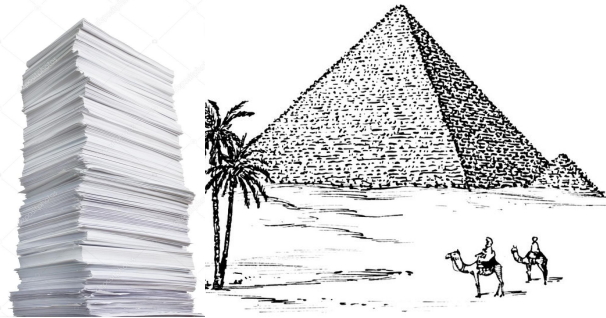




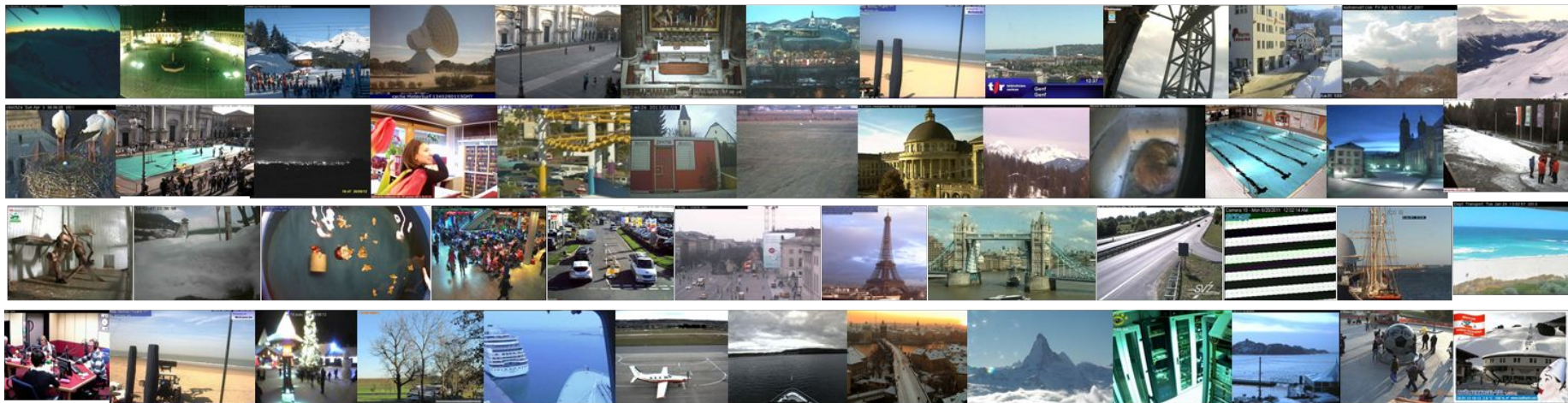
# Most Common Netcam Image

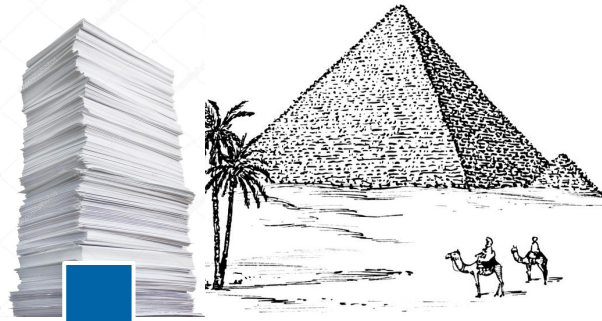
REDDUCI MIT 5011 JAN 27 01:41:30 2015

Exposure: 32800 Temperature F: -6.7



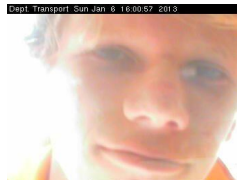
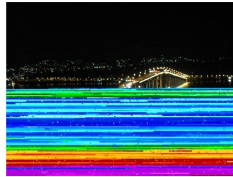
**> 10,000 webcams -- an image every 15 minutes -- ~1,000,000 images per day**





**> 10,000 webcams -- an image every 15 minutes -- ~1,000,000 images per day**

## **Image Tagging & Spotting of Interesting Images**



CHENGDU  
CONTEMPORARY

MUSEUM

KURT  
CAVIEZEL + zhaw  
School of Engineering



# ANIMALS

- >> LIVE
- >> STREAMS ▶
- > XMAS
- AIRPORTS
- AMERICAN
- SELFIES
- ANIMALS
- BEACHES
- BIKES
- BRIDGES
- BLACK SPOTS
- BOATS
- CARS
- CLICKED
- CORRIDORS
- HEAD CAMS
- EXHIBITIONS
- PRESS
- ABOUT
- SUBSCRIBE



**It's More Science Than Art...**



# Be at the Right Place at the Right Time

## Finding the Needle in the Haystack



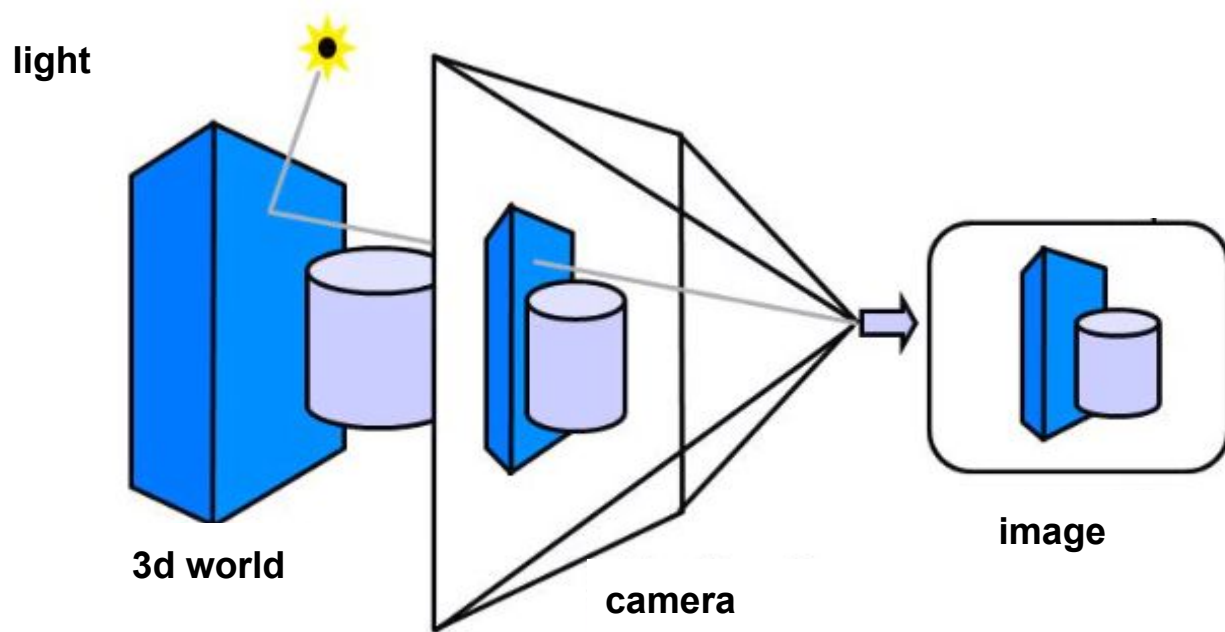
## Image Tagging & Spotting Interesting Images



# Image Tagging & Spotting of Interesting Images

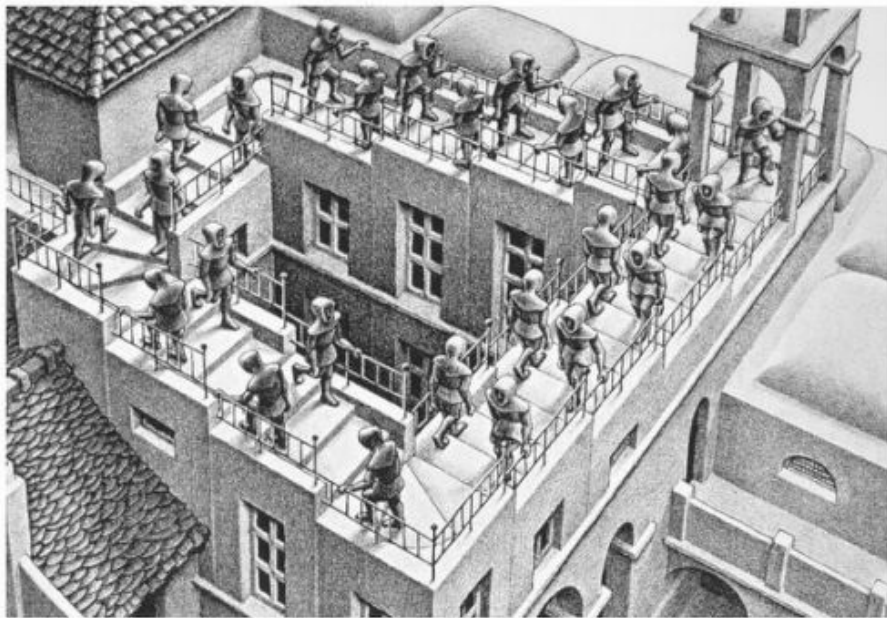


# Computer Vision – Why is it hard?



# 3d - 2d Information Loss

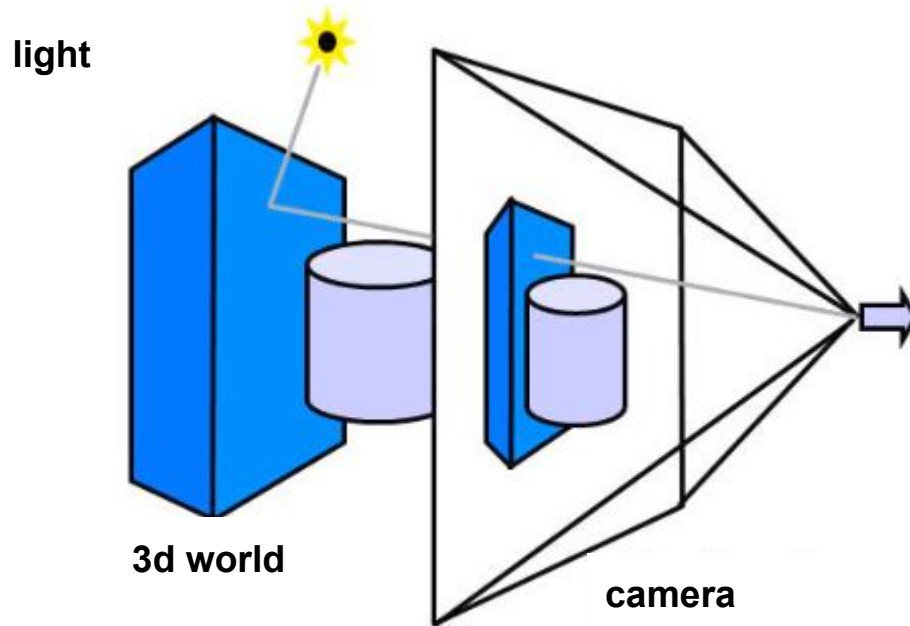
M. C. Escher



Technorama

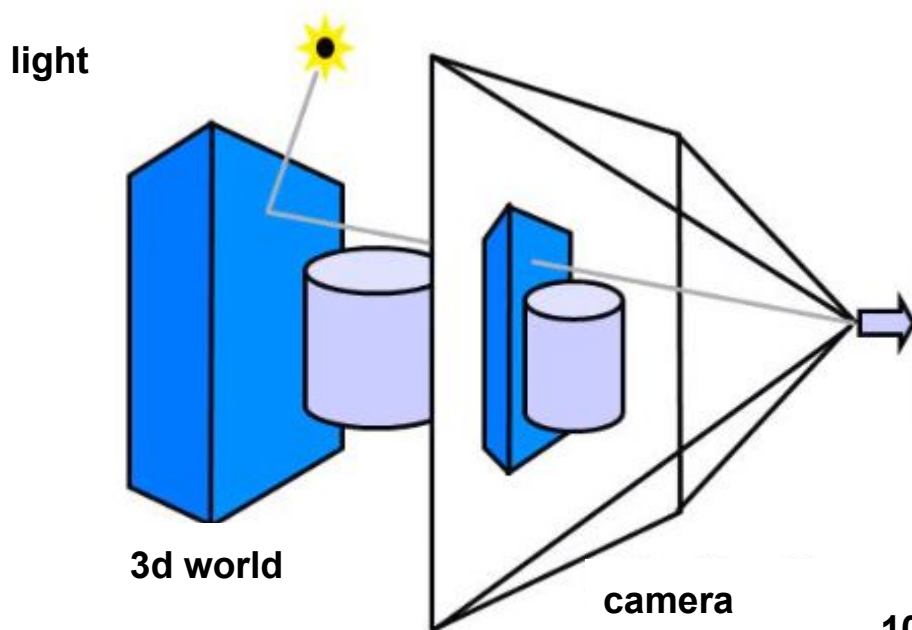


# Computer Vision – Why is it hard?



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168	191	193	158	227	178	143	182	106	36	190
205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	236	187	86	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

# Computer Vision – Why is it hard?



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
180	180	50	14	34	6	10	33	48	106	159	181
206	109	5	124	131	111	120	204	166	15	56	180
194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
189	97	165	84	10	168	134	11	31	62	22	148
199	168										
205	174										
190	216										
190	224										
190	214										
187	196										
183	202										



$10^{80}$  atoms in the universe

$10^{90}$  possible images (8 bit 6 x 6px)

# [DALL·E 2/ Stable Diffusion]

Text input: «Corgi with the Eiffel Tower»







# Image Tagging



# ANIMALS

>> LIVE

>> STREAMS ▶

> XMAS

AIRPORTS

AMERICAN

SELFIES

ANIMALS

BEACHES

BIKES

BRIDGES

BLACK SPOTS

BOATS

CARS

CLICKED



CORRIDORS

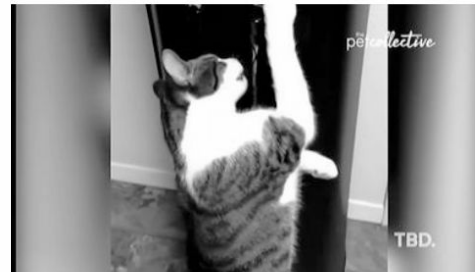
HEAD CAMS

EXHIBITIONS

PRESS

ABOUT

SUBSCRIBE



# Computer Vision – Challenges



# Computer Vision – Challenges

Sheepdog or mop



Chihuahua or muffin



# Computer Vision

Image



Programming

```
def classify(image):  
    #some magic  
    return classLabel
```



Person: yes/ no

# Computer Vision

Image



157	153	174	168	150	152	129	151	172	161	155	156
155	182	163	74	75	62	33	17	110	210	180	154
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194	68	137	251	237	239	239	228	227	87	71	201
172	105	207	233	233	214	220	239	228	98	74	206
188	88	179	209	185	215	211	158	139	75	20	169
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205	174	155	252	236	231	149	178	228	43	95	234
190	216	116	149	235	187	85	150	79	38	218	241
190	224	147	108	227	210	127	102	36	101	255	224
190	214	173	66	103	143	96	50	2	109	249	215
187	196	235	75	1	81	47	0	6	217	255	211
183	202	237	145	0	0	12	108	200	138	243	236
195	206	123	207	177	121	123	200	175	13	96	218

Pixels

Programming

```
def classify(image):
```

```
    #some magic
```

```
    return classLabel
```

Person: yes/ no

**Magic: No obvious way to hard-code the Algorithm! (unlike e.g., sorting numbers)**

# Computer Vision

Image



Programming

```
def classify(image):
```

Person: yes/ no

## Machine Learning to Rescue!

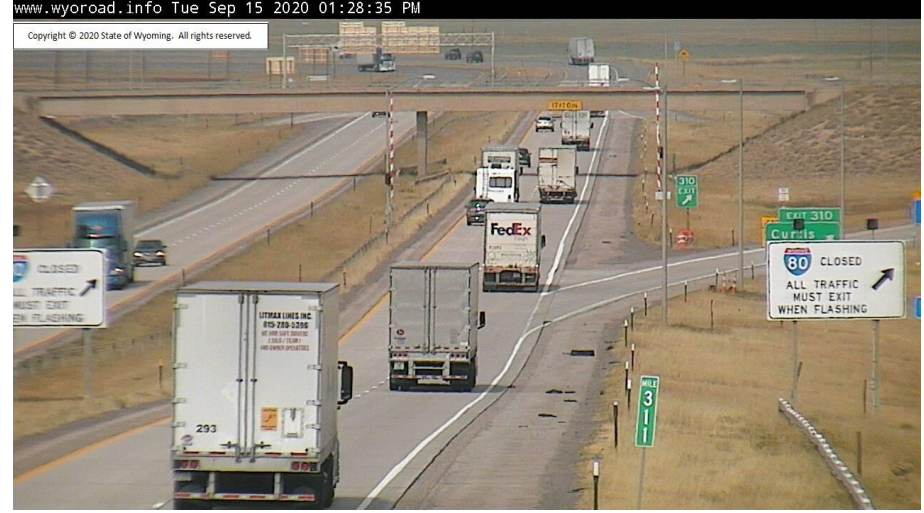
155	182	163	74	75	62	33	17	110	210	180	154
180	180	80	14	34	6	10	33	49	106	159	181
206	109	6	124	131	111	120	204	166	16	66	180
194	68	137	261	237	236	239	228	227	87	71	201
172	106	207	233	233	214	220	239	229	99	74	206
188	88	179	209	189	219	211	198	199	76	30	169
189	97	166	84	10	168	134	11	31	62	22	148
199	168	191	193	168	227	179	143	182	106	36	190
209	174	199	252	236	231	149	178	228	43	95	234
190	210	116	149	236	187	86	160	79	38	210	241
190	224	147	108	227	210	127	102	36	101	250	224
190	214	173	66	103	143	96	80	2	109	240	210
187	194	236	76	1	81	47	0	4	217	205	211
183	202	237	146	0	0	12	109	200	199	243	206
196	206	123	207	177	121	123	200	176	13	86	218

Pixels

**Magic: No obvious way to hard-code the Algorithm! (unlike e.g., sorting numbers)**







# Monobloc

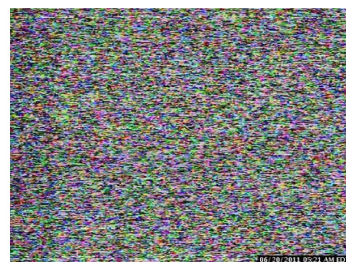
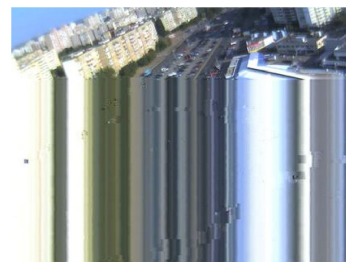
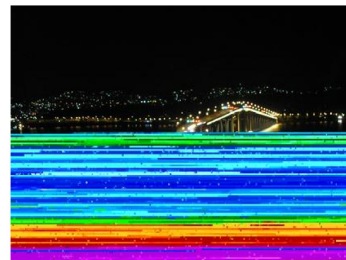
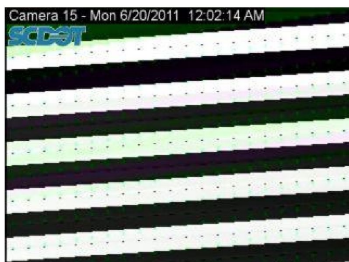
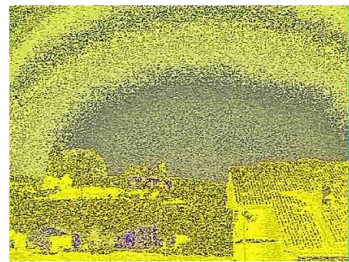
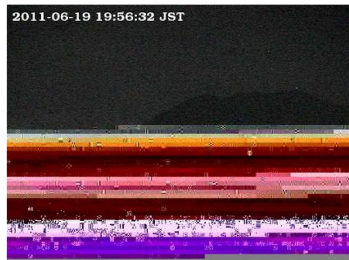
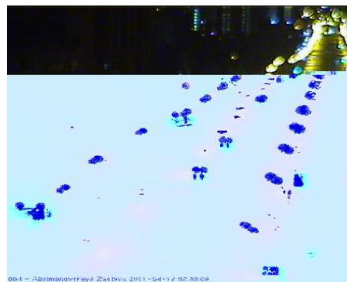
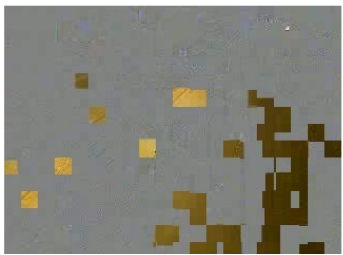


# Images that pretend to be no image

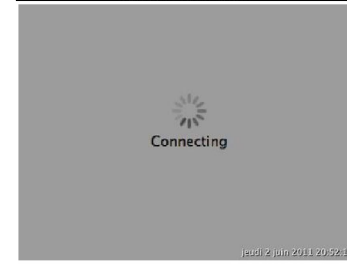
*kein Bild*

Image  
out of service

# Data and Patterns



# Out of Service



# Black Spots – “Punctum”

An incidental but personally poignant detail in a photograph which 'pierces' or 'pricks' a particular viewer, constituting a private meaning unrelated to any cultural code. [Barthes, A Dictionary of Media and Communication]

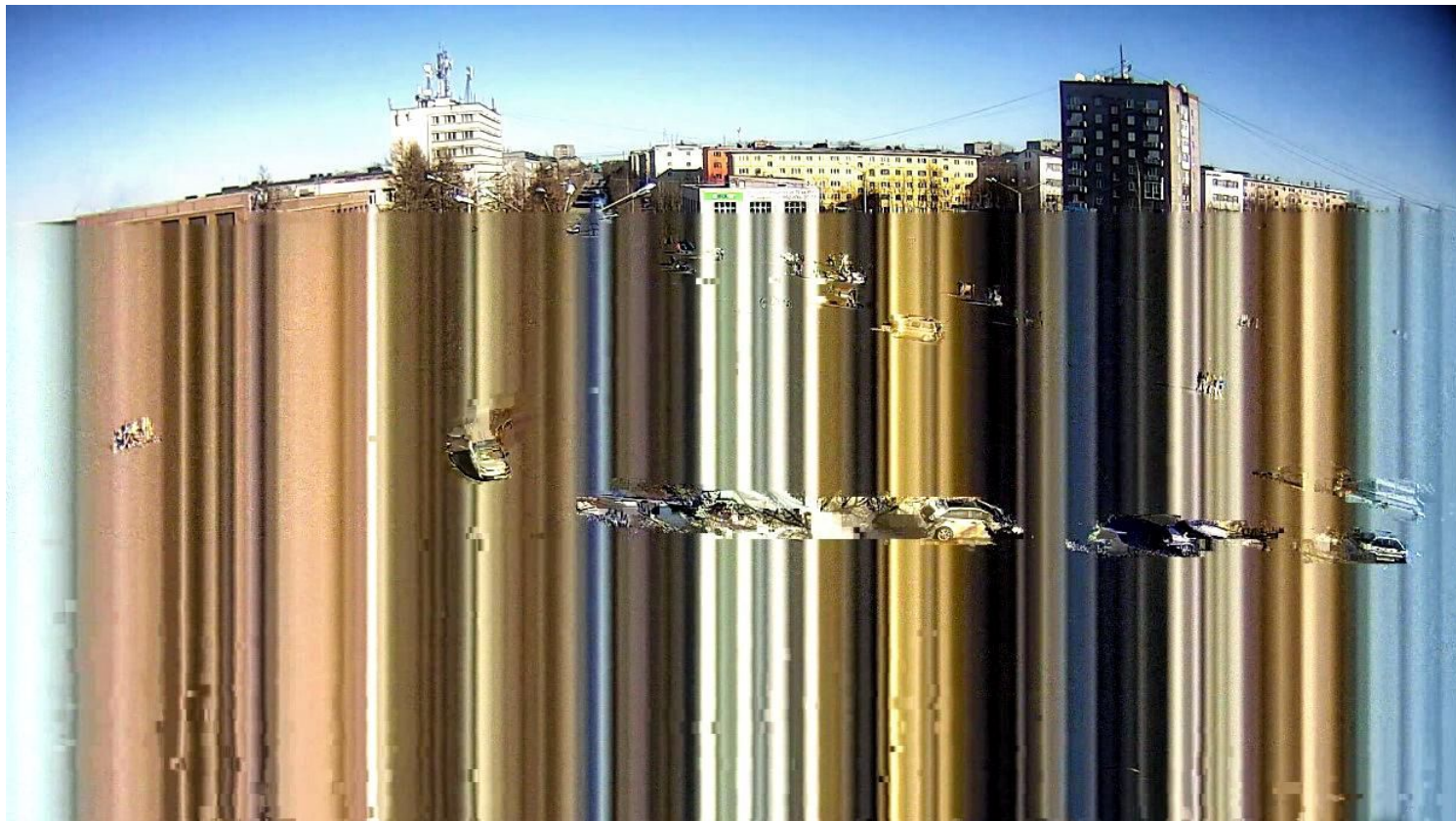


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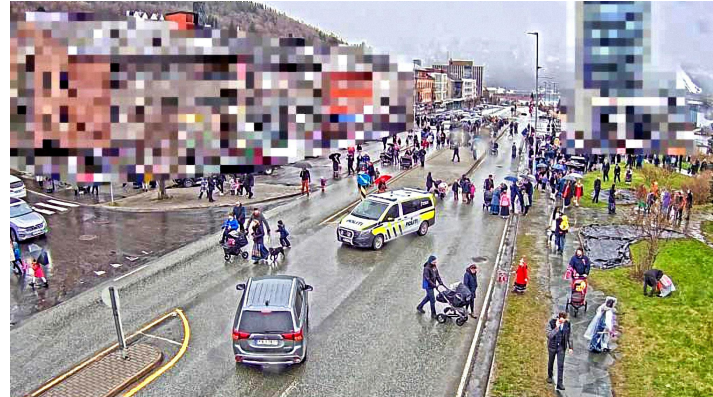
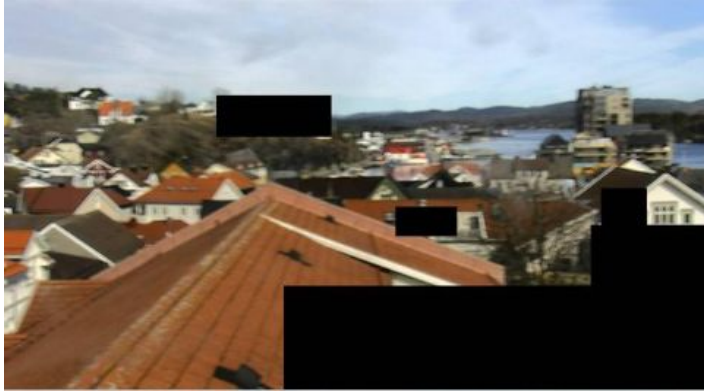


# Data and Patterns

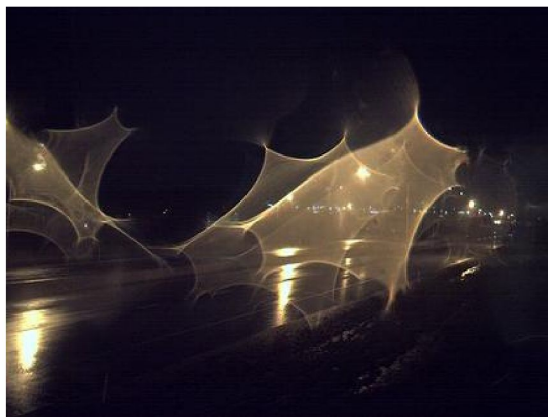




# “Public Hiding”



# Coverings



# Coverings



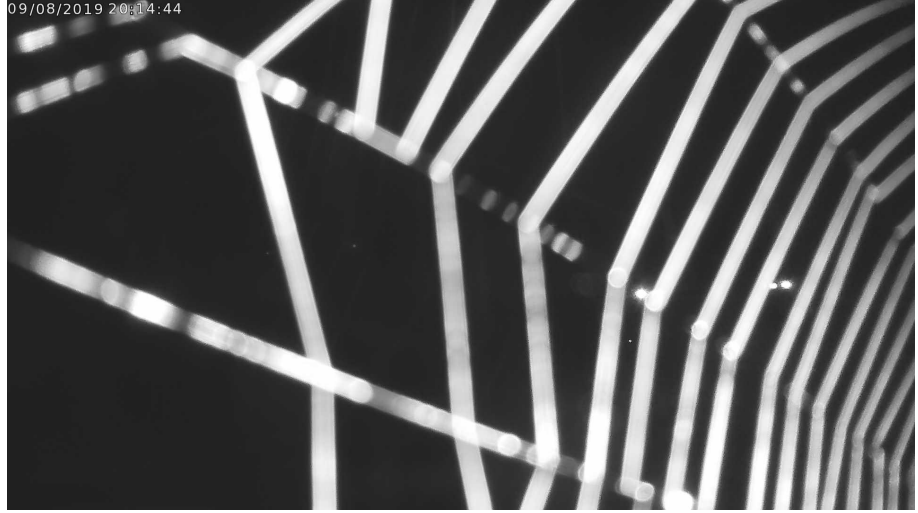


10-06-2020 22:10:31



Camera 02

09/08/2019 20:14:44



Rifugio Vittoria - Lago Santo mt.1501 slm

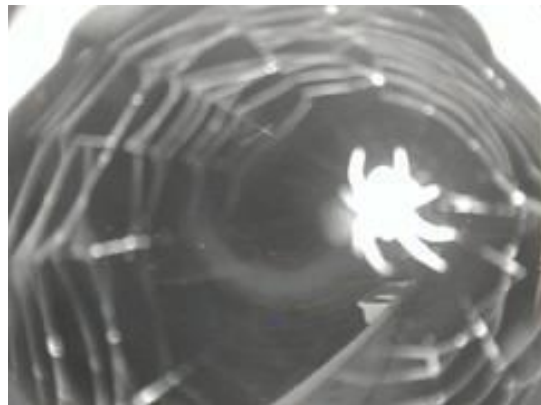
09 ottobre 2020 19:12:08



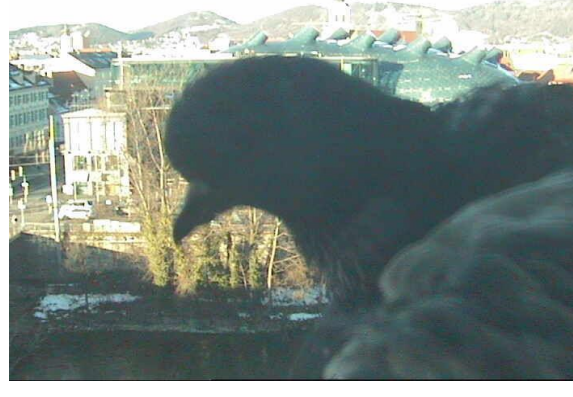
# Insects & Birds



mohrenwirt.com Mon Jun 6 11:20:00 2011



www.mohrenwirt.com 2012-08-13 12:50 UTC



# Animals



# People

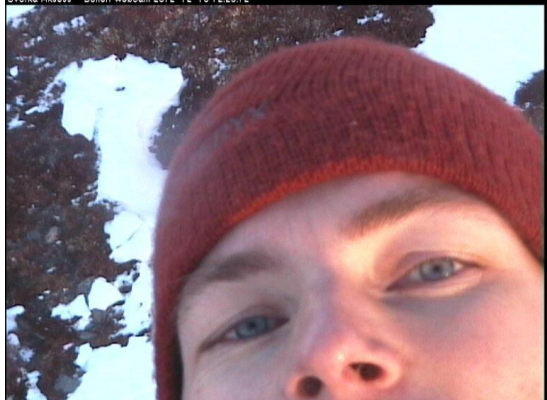
Dept. Transport Sun Jan 6 16:00:57 2013



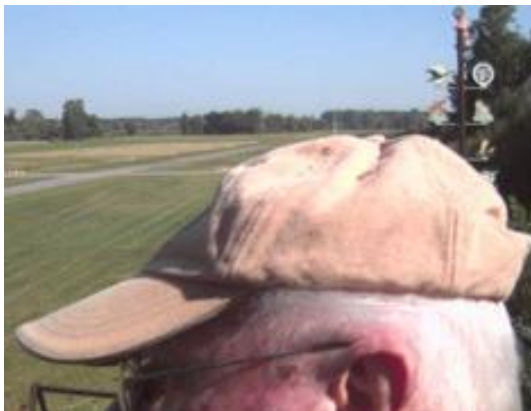
13:40:22 2012/09/07



Svorka Akassa - Bollen webcam 2012-12-18 12:20:12

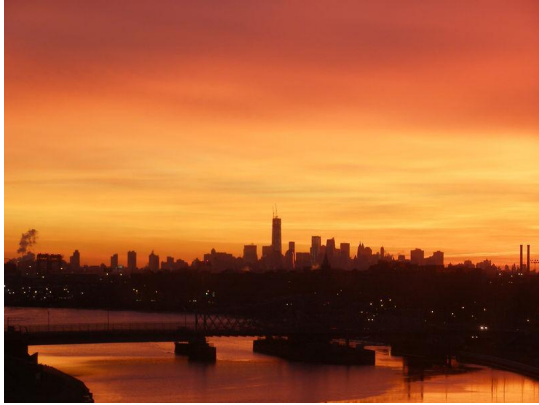


2012-06-20 10:20:15





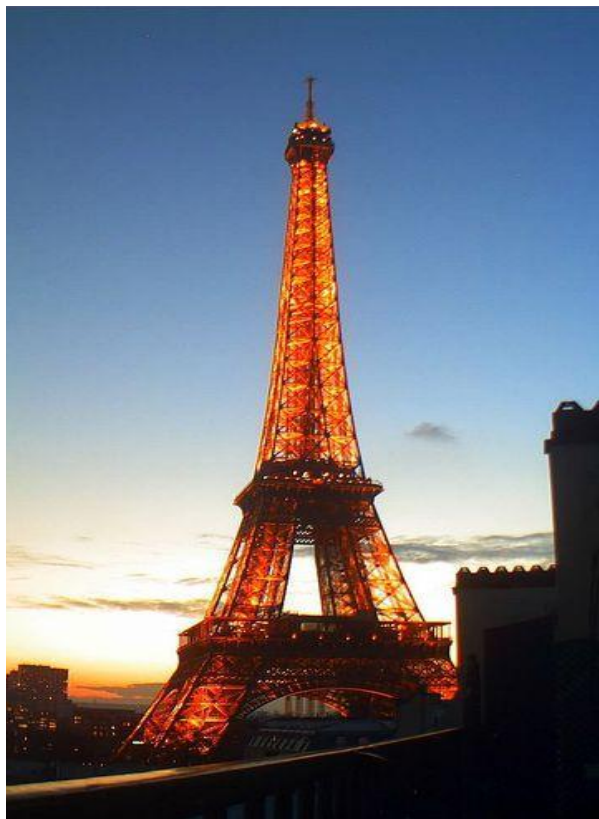
# Be at the Right Place at the Right Time



013/01/08 17:16:26



# Be at the Right Place at the Right Time



# Looking Back on Us (the Real Us)



2023-12-03 09:09:32

IP Camera



2023-12-05 20:54:55

crippin.net

2023-12-04 15:46:10

crippin.net

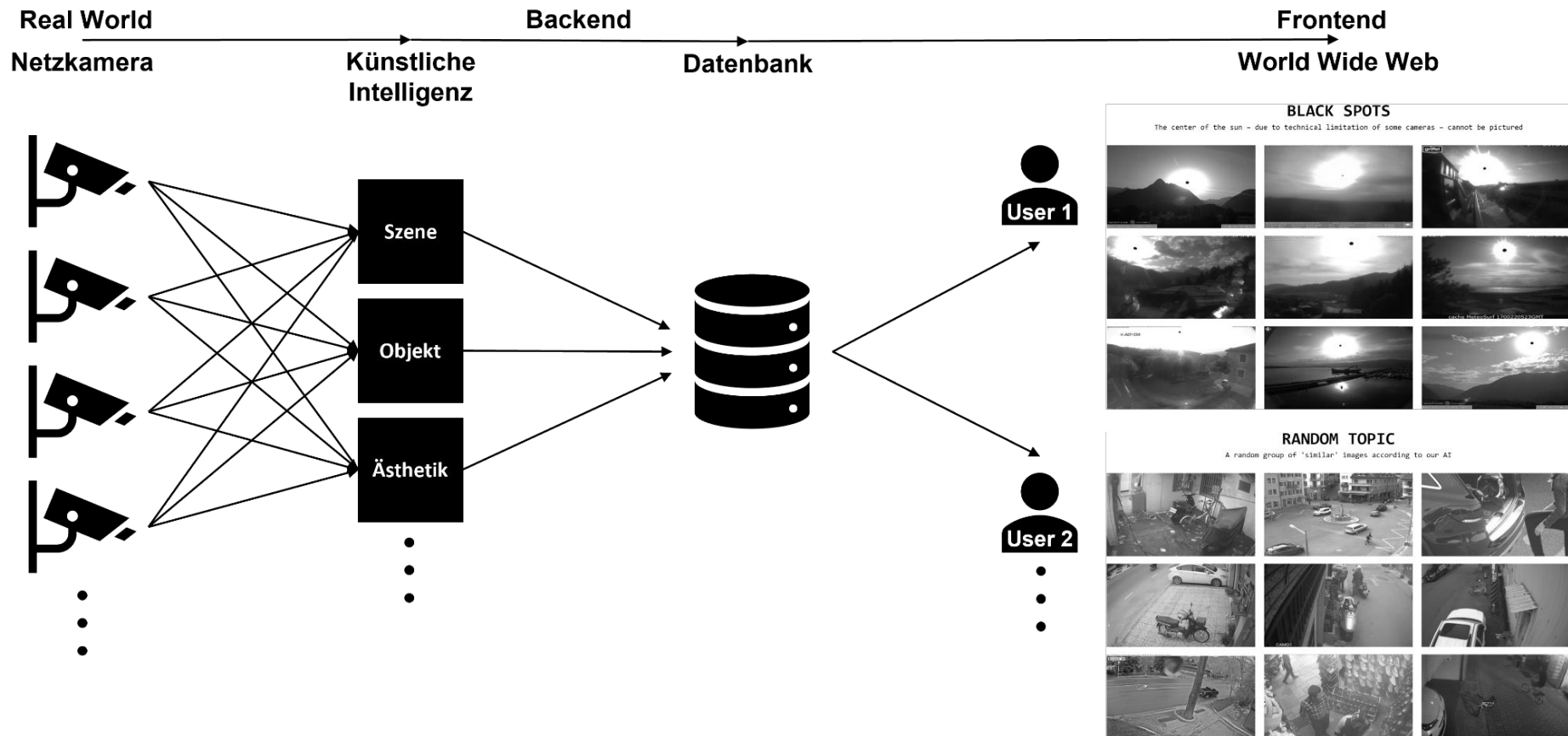




# The System







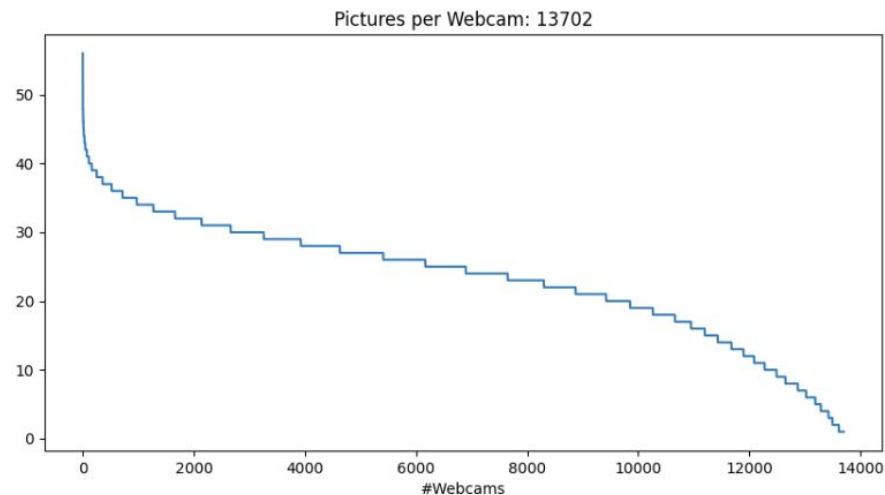
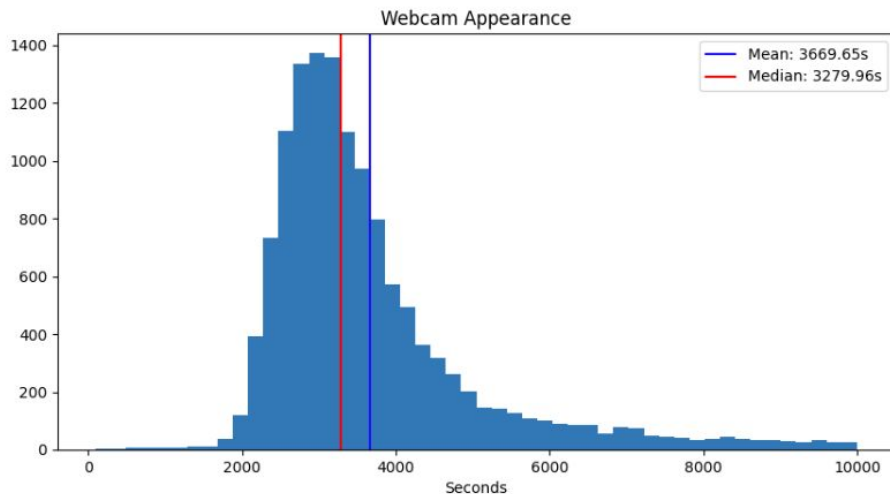
# The System

## 4 virtual server SoE

- 1 server: web-server/ SQL database
- 3 “worker”: 8 cores each (no GPU)

## Processing

- homegrown data processing pipeline (no Spark)
- randomized processing



# Spotting of Interesting Images



www.jjyan.co.uk



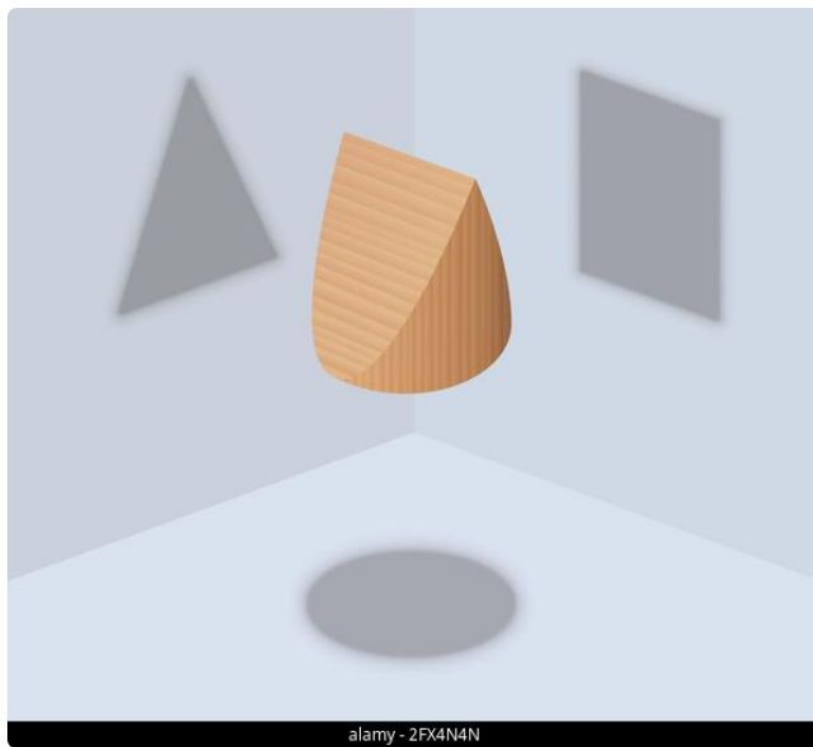
# Images...

... tell stories, send messages, trigger emotions and memories.



**Interestingness – the power of attracting or holding one's attention.**

HE

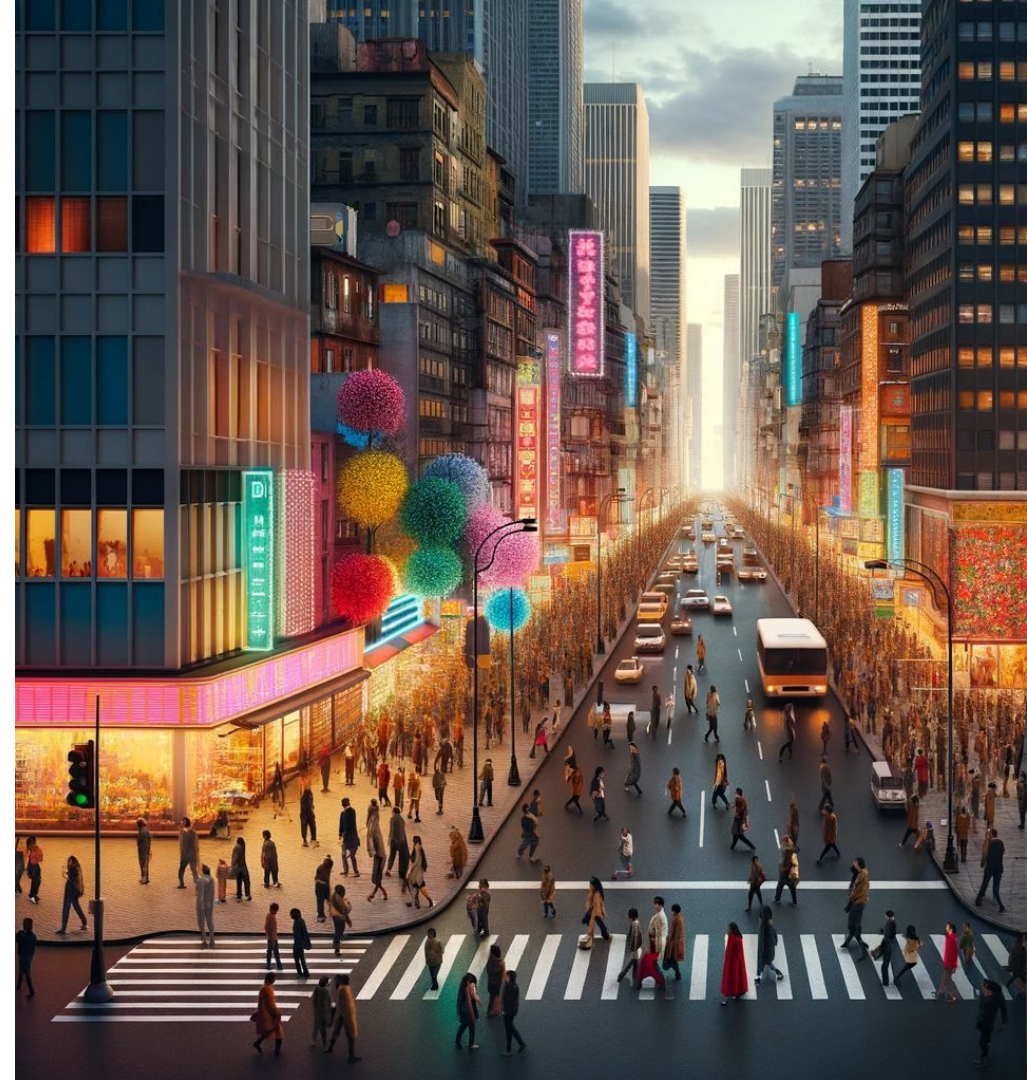


is this image interesting?



The image features an abstract design with geometric shapes. Whether or not it's interesting is subjective and varies from person to person. Some might find the simplicity and geometry appealing, while others might prefer more intricate or colorful designs. What are your thoughts on it?





# What is “interesting”?

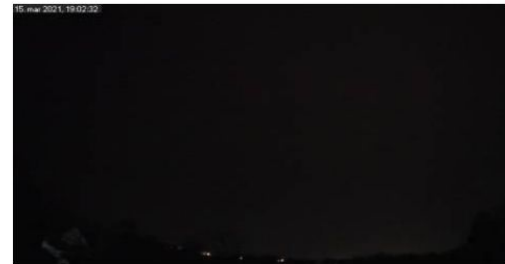
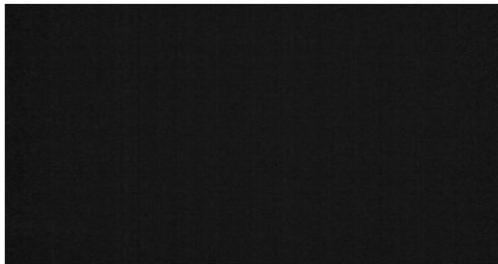
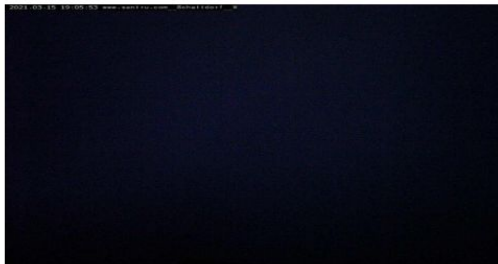
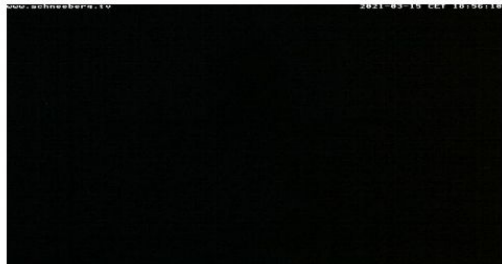
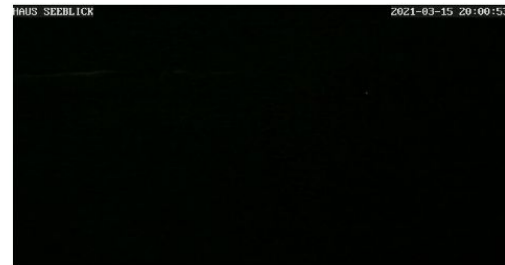
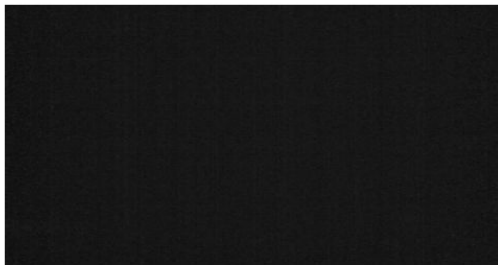
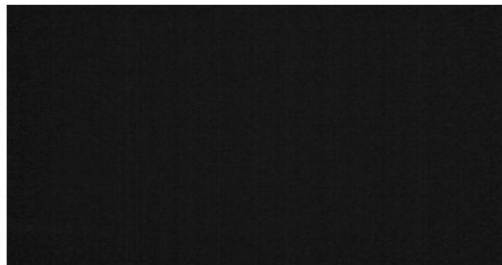


## **Schwarzes Quadrat**

Kasimir Malewitsch

Viereck, 1915

Oil on canvas, 79,5 cm × 79,5 cm





# Images...

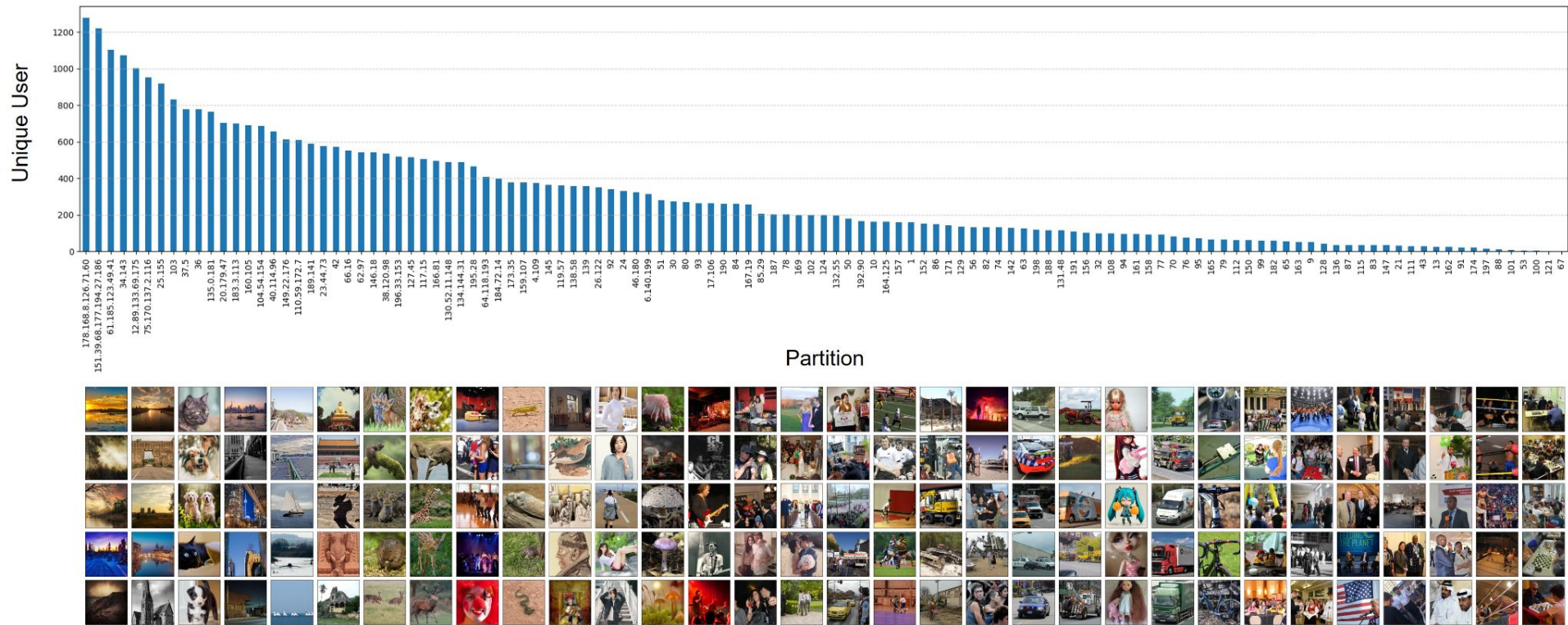
... tell stories, send messages, trigger emotions and memories.



**Interestingness – the power of attracting or holding one's attention.**

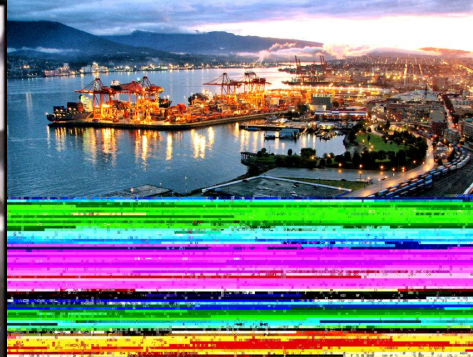
**USER  
CONTEXT  
TASK**

# Commonly Interesting Images

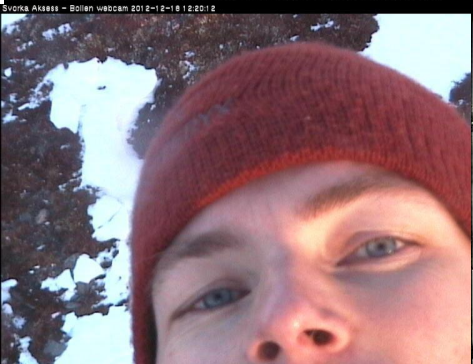


**More to come, stay tuned...**

**COMING SOON**



**All images are equal, but some images are more equal than others.**



www.SANParks.org satara Jan-24, 2013 - 13:49:30 SAST

Svovka Ak888 - Bollen webcam 2012-12-18 12:20:12

mohrenwirt.com Mon Jun 6 11:20:00 2011

Time: 12:30