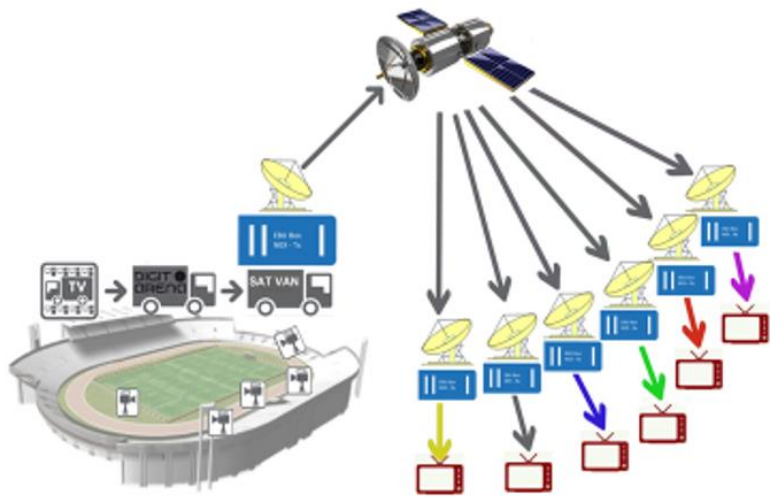




Players' segmentation in football for TV: Do computer vision and machine learning methods work?

20th June 2018
Forum TERATEC

Provide personalized TV broadcast advertisements for countries during live sport events with 1 signal



video

Rank	Country	Time	Diff
1	NORWAY	1:00:10.1	
2	GERMANY		+14.4
3	ITALY		
4	RUSSIA		
5	FRANCE		
6	SWEDEN		
7	CZECH REPUBLIC		
8	USA		
9	SWITZERLAND		

System expert: Computer vision algorithm



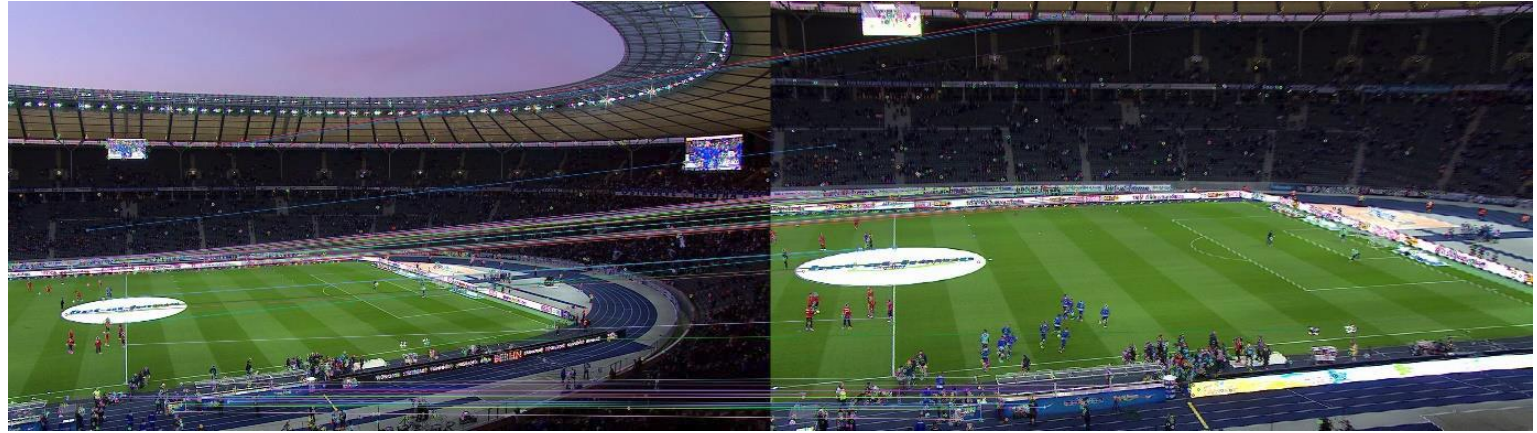
Banner subtraction



=



Keypoint detection



System expert: Computer vision algorithm

Too many sensitive parameters

Shadow



Rain



Smoke



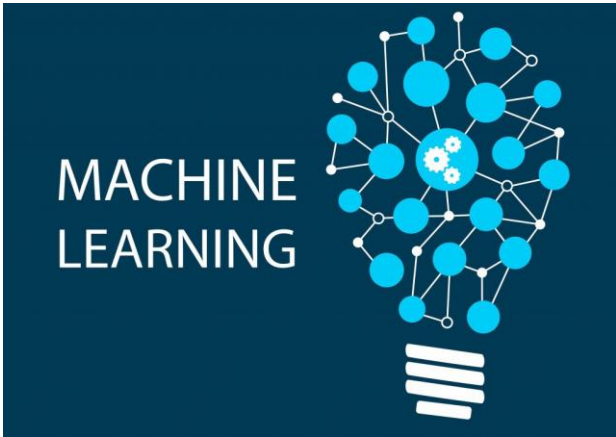
Snow



Blur

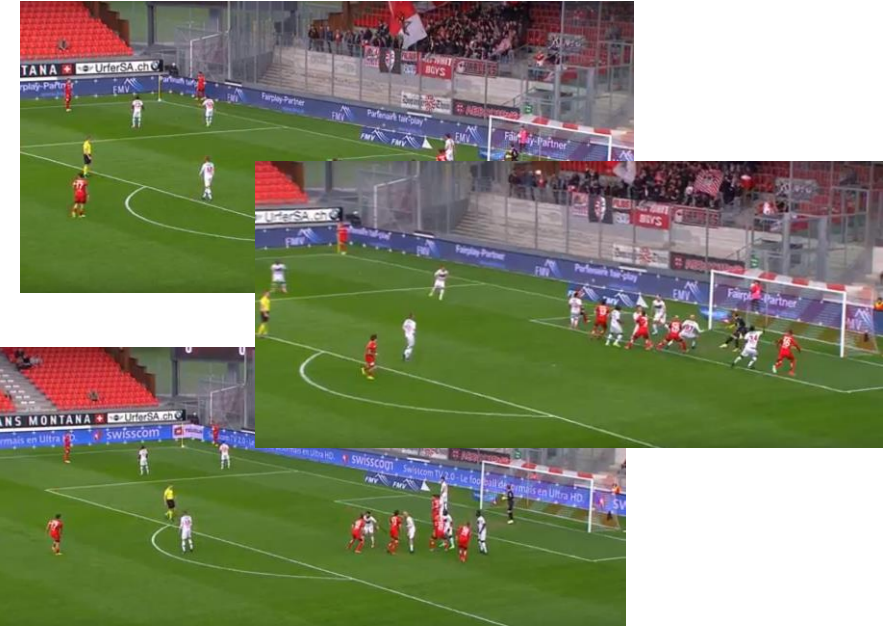


What is happening on the market?

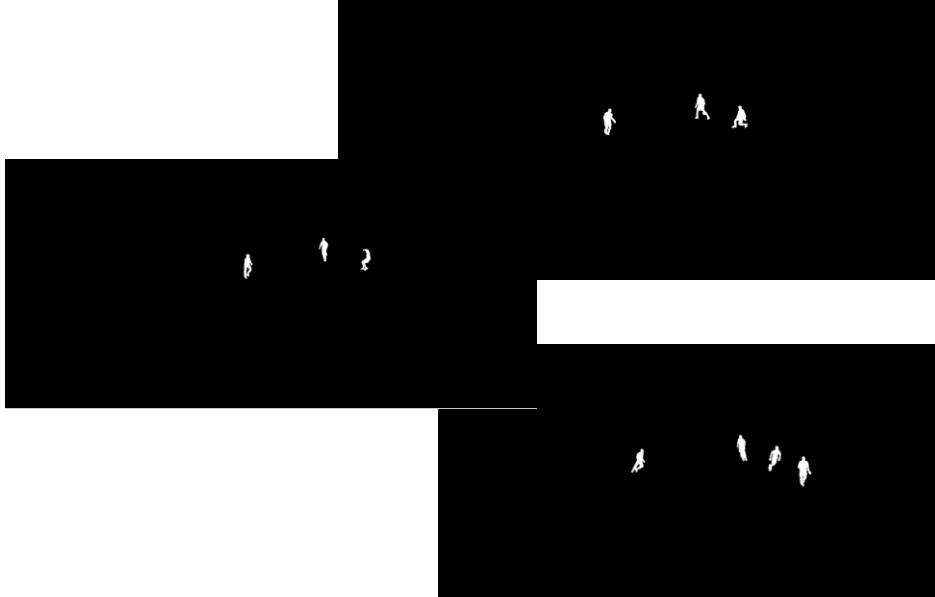


Input * **A** = output
Aim is to find **A**

Input

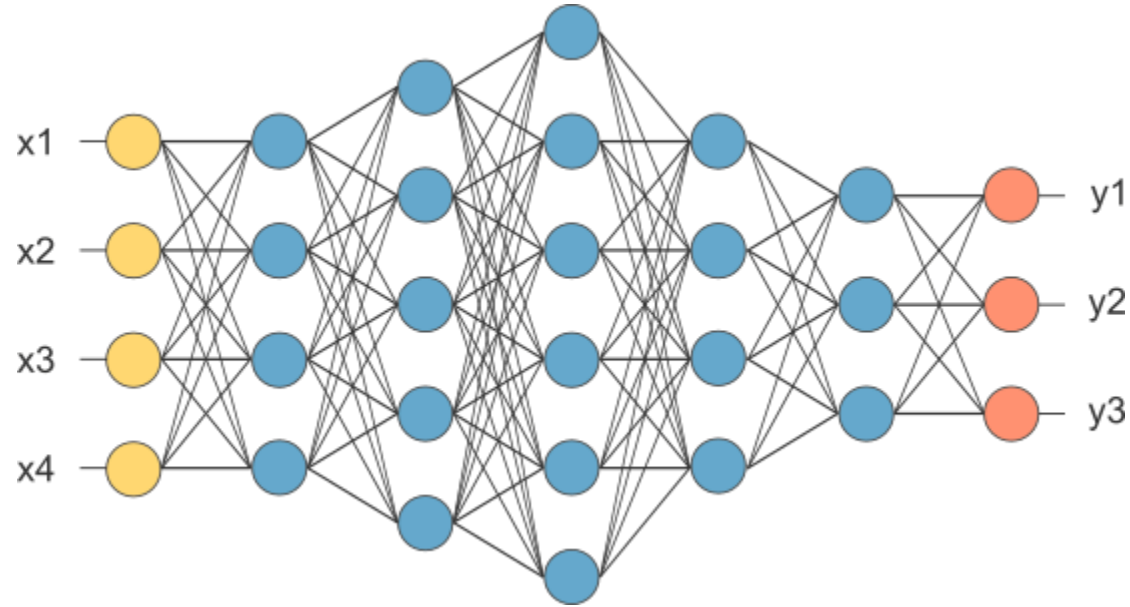


Output



Machine learning: model and data

Which model ?



Which data ?

1 match = 90minute
Framerate = 25 image per second
Segment 50 images => 2h

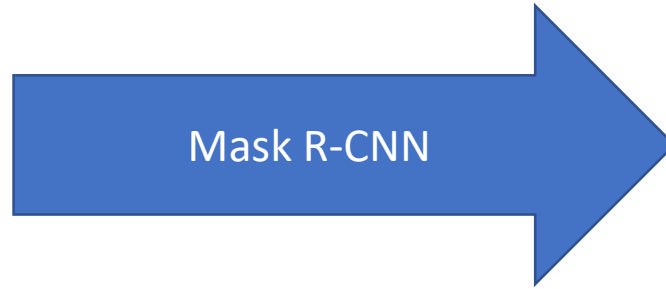
25*60*90=135 000 images
1 match = 32 months for ground truth

Use an already existing model: Mask R-CNN

Image sample



Model trained by Facebook



Ground truth made by community (COCO)



How to use the model?



1) Load model

```
COCO_MODEL_PATH = os.path.join(ROOT_DIR, "mask_rcnn_coco.pth")
model = modellib.MaskRCNN(model_dir=MODEL_DIR, config=config)
model.load_state_dict(torch.load(COCO_MODEL_PATH))
```

2) Load input

```
IMAGE_DIR = os.path("pathToImages")
file_names = next(os.walk(IMAGE_DIR))[2]
image = skimage.io.imread(os.path.join(IMAGE_DIR, random.choice(file_names)))
```

3) Define output

```
class_names = ['person', 'sports ball']
```

4) Run

```
results = model.detect([image])
```


Result on raw data

Original image



Result



Data domain

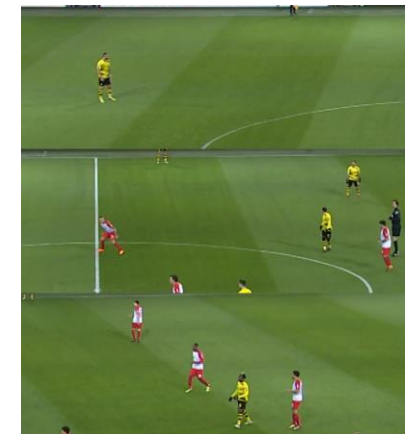
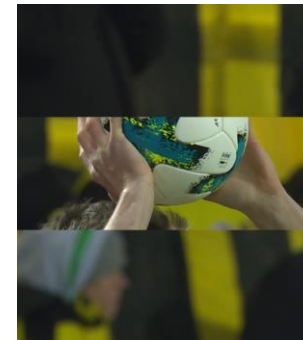
COCO data:



DigitArena data:



DigitArena
pre-processed data:



Result with pre-processed data

Origin



Mosaic

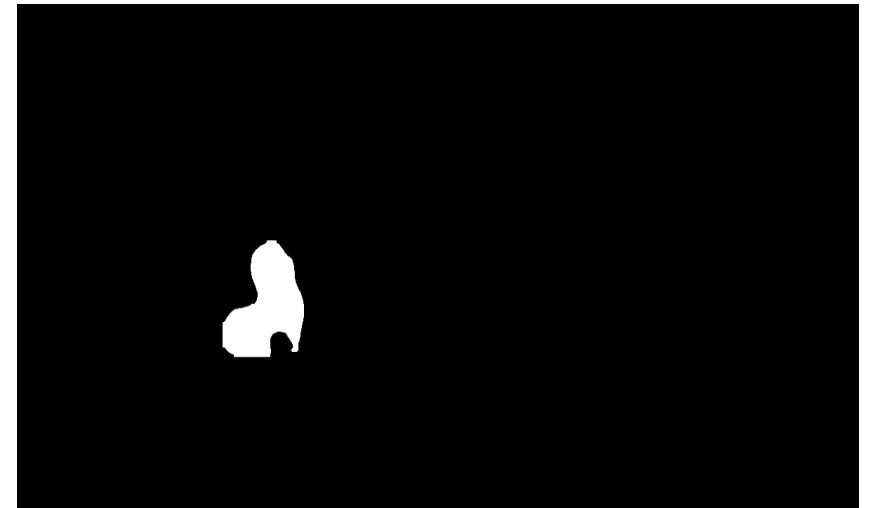


Image directory

Methods comparison: Good and Bad

Method	Good	Improvement points	Bad
Computer vision	<ul style="list-style-type: none">• Total control	<ul style="list-style-type: none">• Performances	<ul style="list-style-type: none">• Long delivery• Require specific skills• Too many sensitive parameters• Does not manage uncertainty
Machine learning	<ul style="list-style-type: none">• Quick result• No specific skills to have to use	<ul style="list-style-type: none">• Work on every weather• Sufficient quality• Performances• Temporal dependencies• Groundtruth validation• Groundtruth error handling• Synthetic groundtruth	<ul style="list-style-type: none">• Model not controlled• Model not optimized• Domain data• Performances



- Run machine learning algorithm on different data sets (snow, rain, ...)
- Retrain existing model with specific data (need specific skills)
- Add temporal coherency (image n and $n+1$ are not independent)
- Knowing where players are using machine learning, focus on bounding box for computer vision algorithm

Conclusion:

Players' segmentation in football for TV: Do computer vision and machine learning methods work?

Method	Is it working?	TV requirement			
		Framerate	Quality	Cost	Repeatable
Computer Vision	No	No	No	Too expensive	No
Machine learning	Probably	Maybe	Maybe	Unknown	Maybe

Other systems using specific devices work better:

- Infrared cameras
- Specific LED panel



**Develop methods using only software cost too much, is long to develop and is not guarantee to work.
Methods based on specific hardware are quicker and work far better.**

Thanks

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