

Applicazioni d'Intelligenza Artificiale su contenuti multimediali

Dalla sfera di cristallo al mondo reale



Exploration

Data Preparation, Dataset Augmentation,
Jupyter Notebooks, Model Definition,
Toy Datasets, Hyperparameters, Model Tuning,
Output Metrics Evaluation, ... a lot of coffee

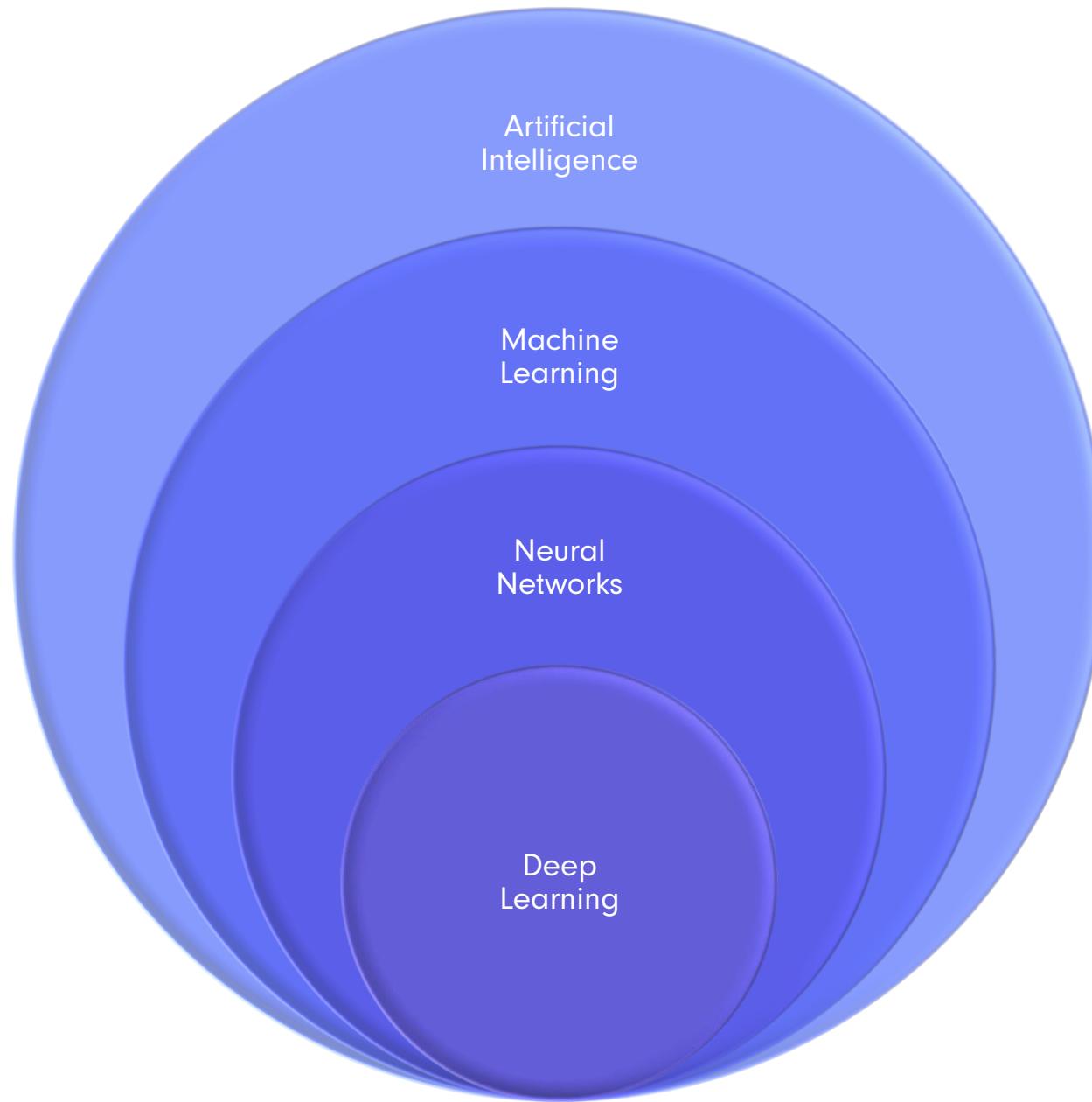
Engineering & MLOps

Machine Learning Pipelines Definition,
Code Re-engineering, Automatic Testing,
CI/CD Pipelines, Performance Testing

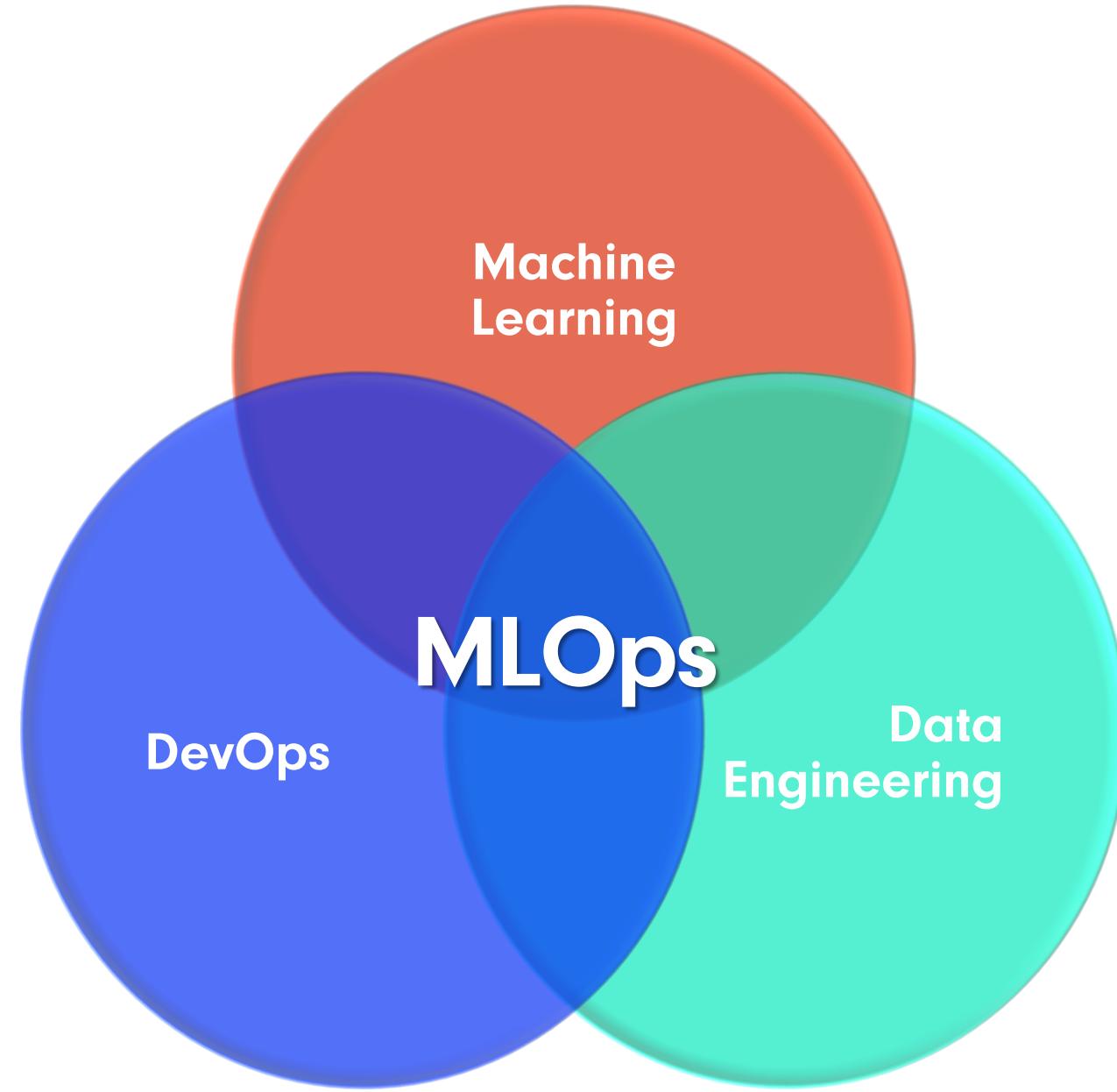
Production Ready

Infrastructure as Code,
End to End Testing with real datasets,
Performance Tuning, Data Security,
Infrastructure Security, App/Service Integration,
Monitoring

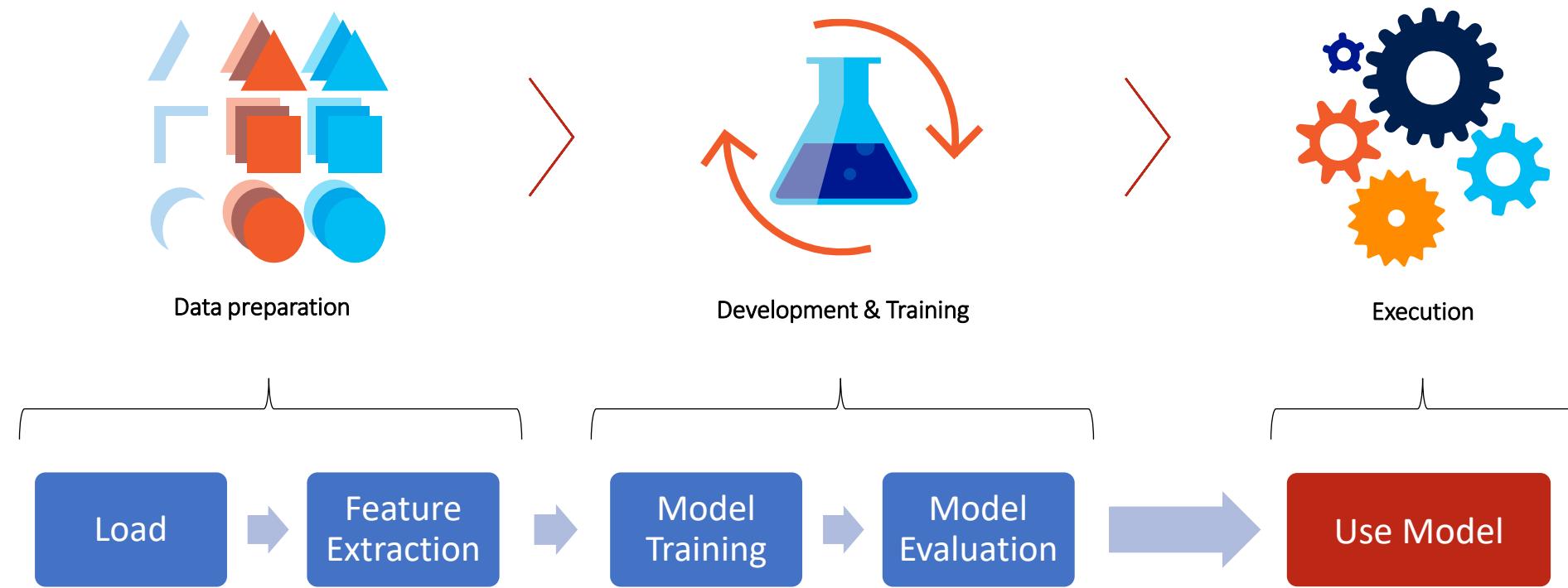
Artificial Intelligence



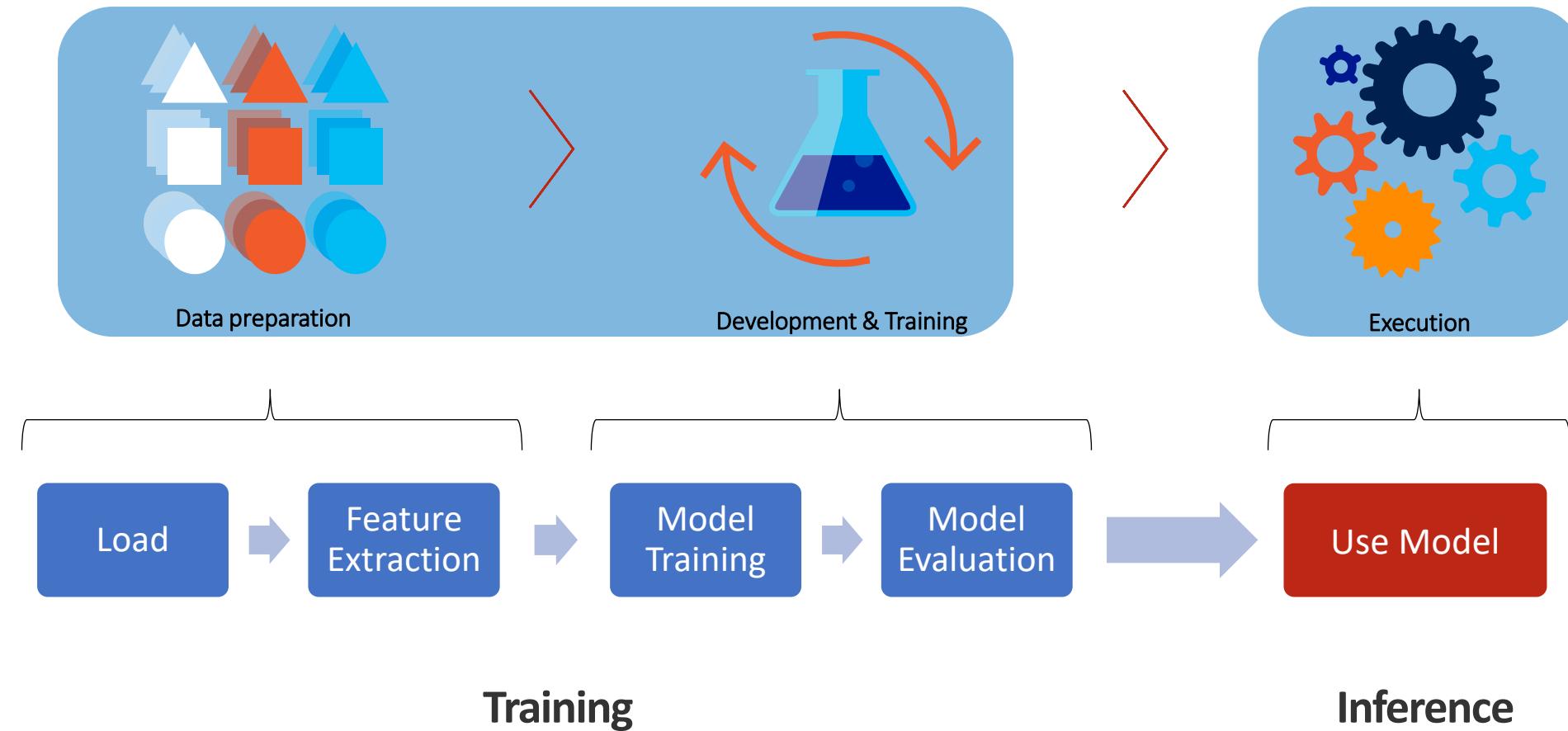
Artificial Intelligence



Typical ML Workflow



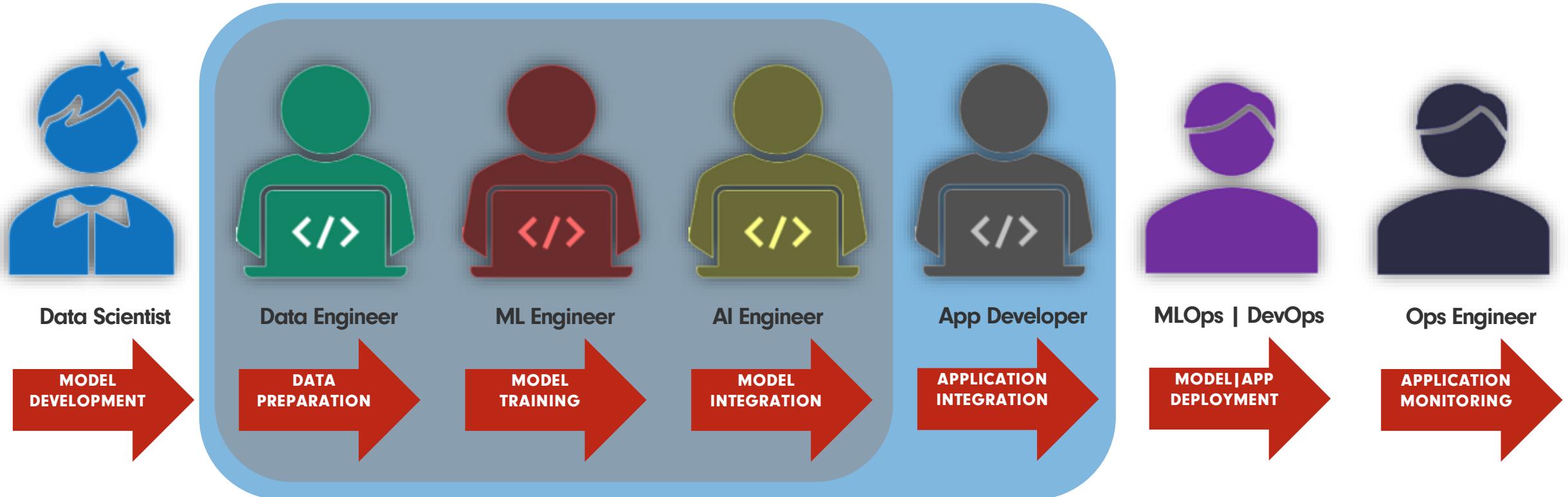
Training vs Inference/Scoring



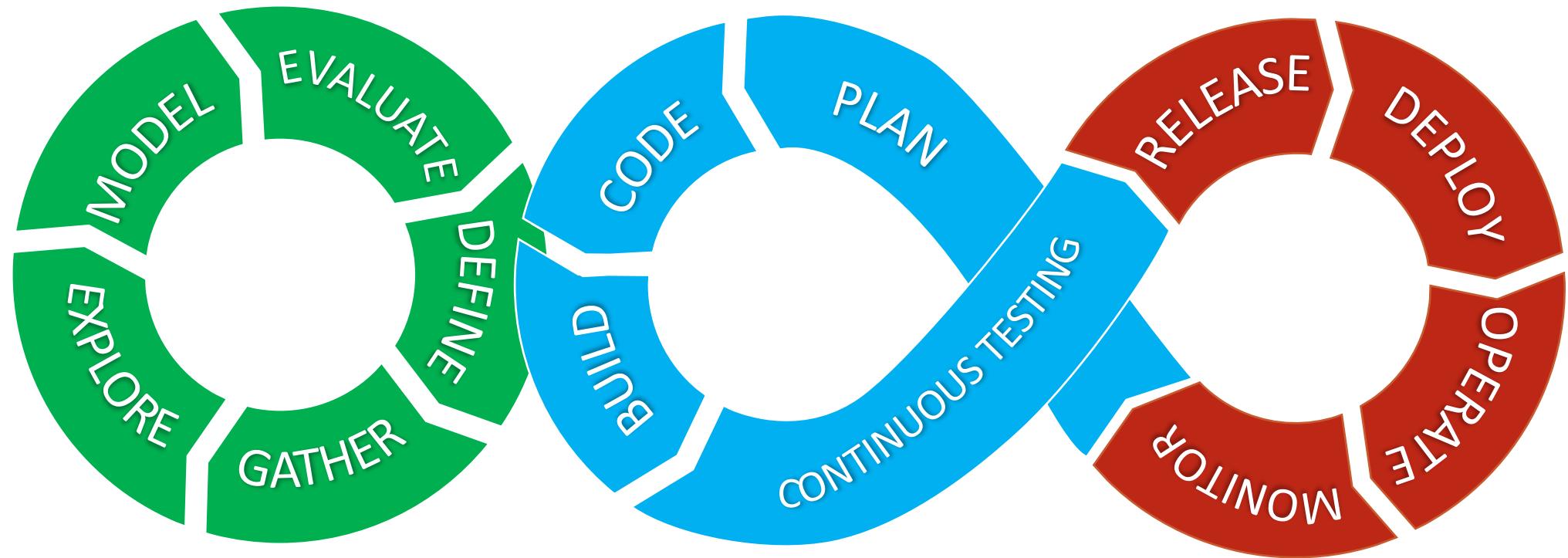
THE A-TEAM



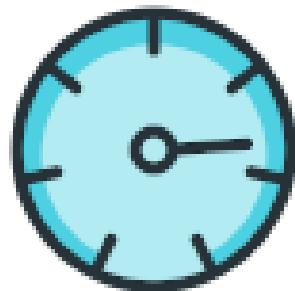
Typical ML Project Team



The forgotten exploration phase



MediaPipe



End-to-End acceleration: Built-in fast ML inference and processing accelerated even on common hardware

Build once, deploy anywhere: Unified solution works across Android, iOS, desktop/cloud, web and IoT



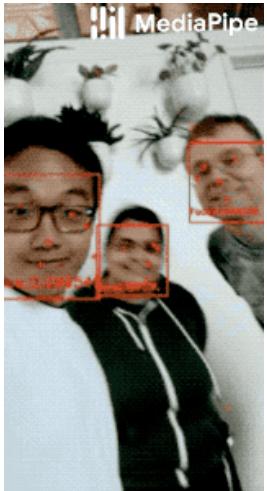
Ready-to-use solutions: Cutting-edge ML solutions demonstrating full power of the framework

Free and open source: Framework and solutions both under Apache 2.0, fully extensible and customizable

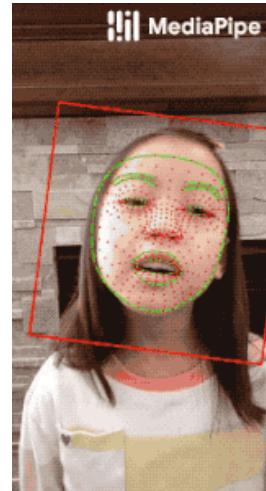


MediaPipe

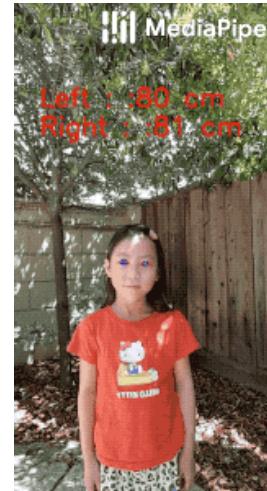
Face Detection



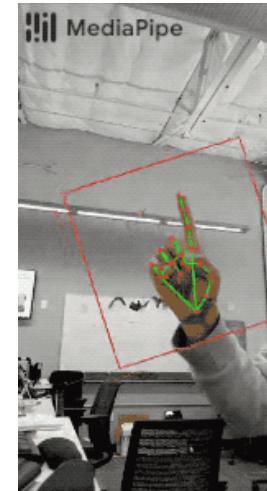
Face Mesh



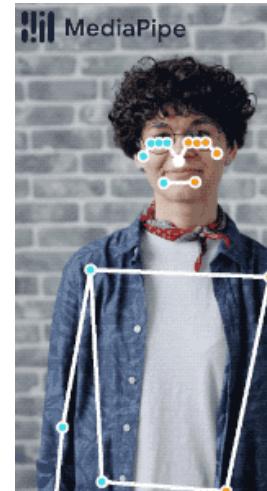
Iris



Hands



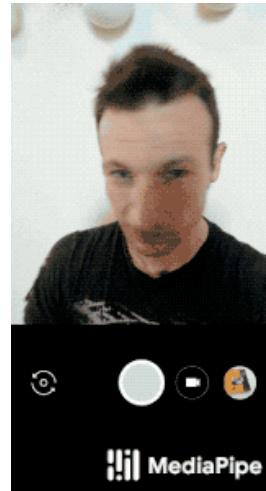
Pose



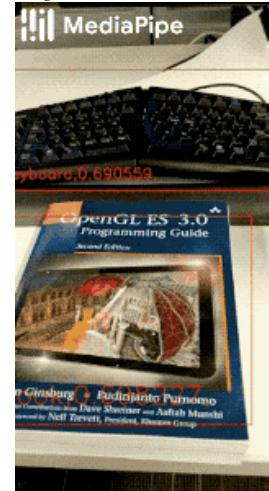
Holistic



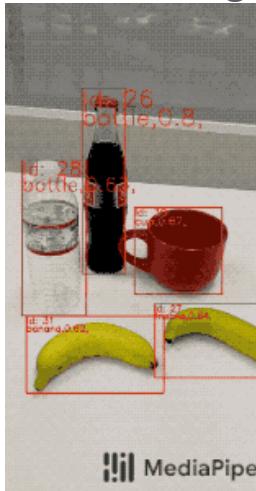
Hair Segmentation



Object Detection



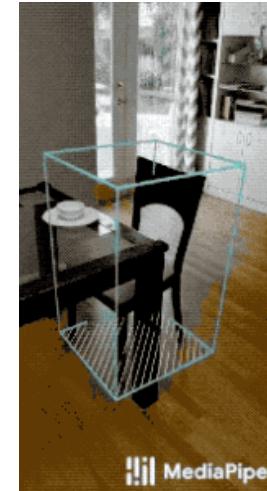
Box Tracking



Instant M.T.

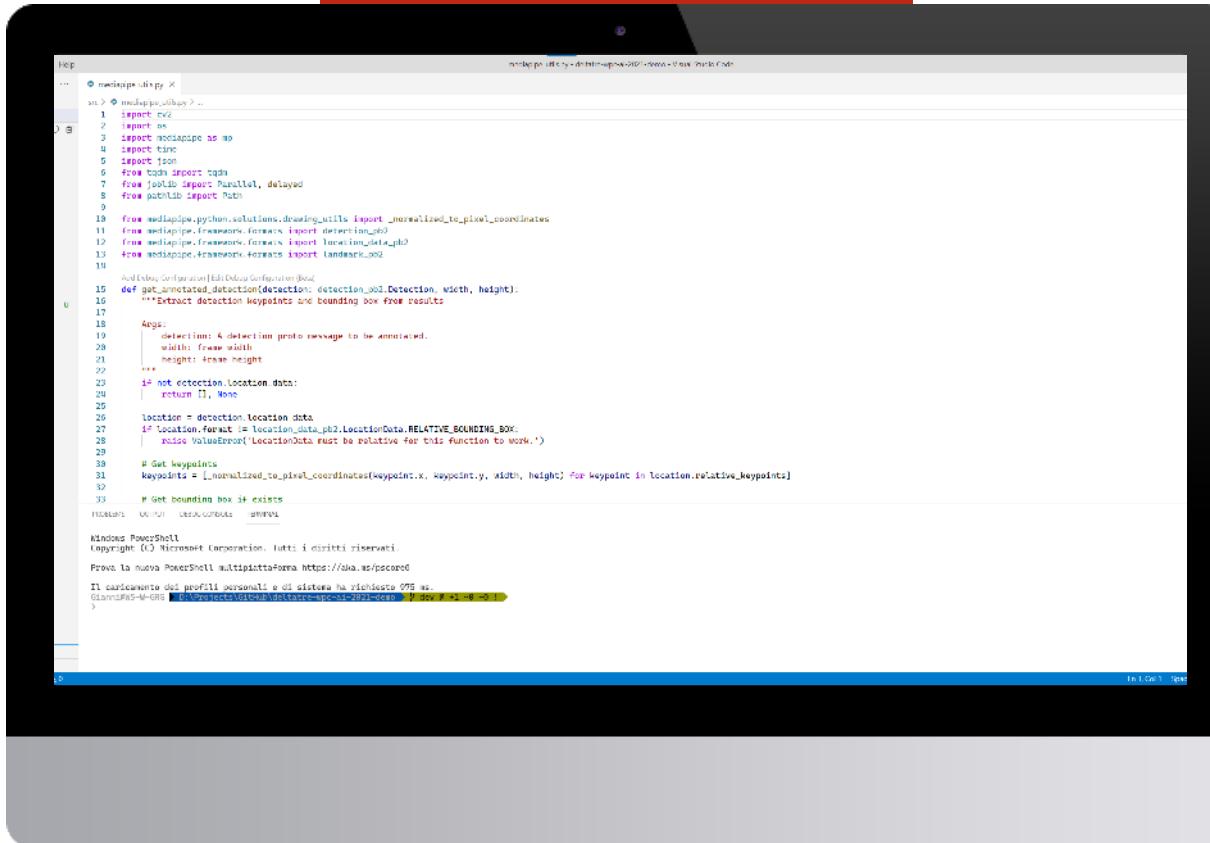


Objectron



KNIFT





```
mediapipe_utils.py
...
def get_annotationed_detection(detection_pb2.Detection, width, height):
    """Extract detection Keypoints and bounding box from results.

    Args:
        detection_pb2.Detection proto message to be annotated.
        width: frame width.
        height: frame height.
    ...
    if not detection.location_data:
        return [], None
    location = detection.location_data
    if location.format != location_data_pb2.LocationData.RELATIVE_BOUNDING_BOX:
        raise ValueError('LocationData must be relative for this function to work.')
    ...
    # Get keypoints.
    keypoints = [_.normalized_to_pixel_coordinates(keypoint.x, keypoint.y, width, height) for keypoint in location.relative_keypoints]
    ...
    # Get bounding box if exists.
    bounding_box = None
    if location.bounding_box:
        bounding_box = location.bounding_box
    ...
    return keypoints, bounding_box
```

Demo: MediaPipe

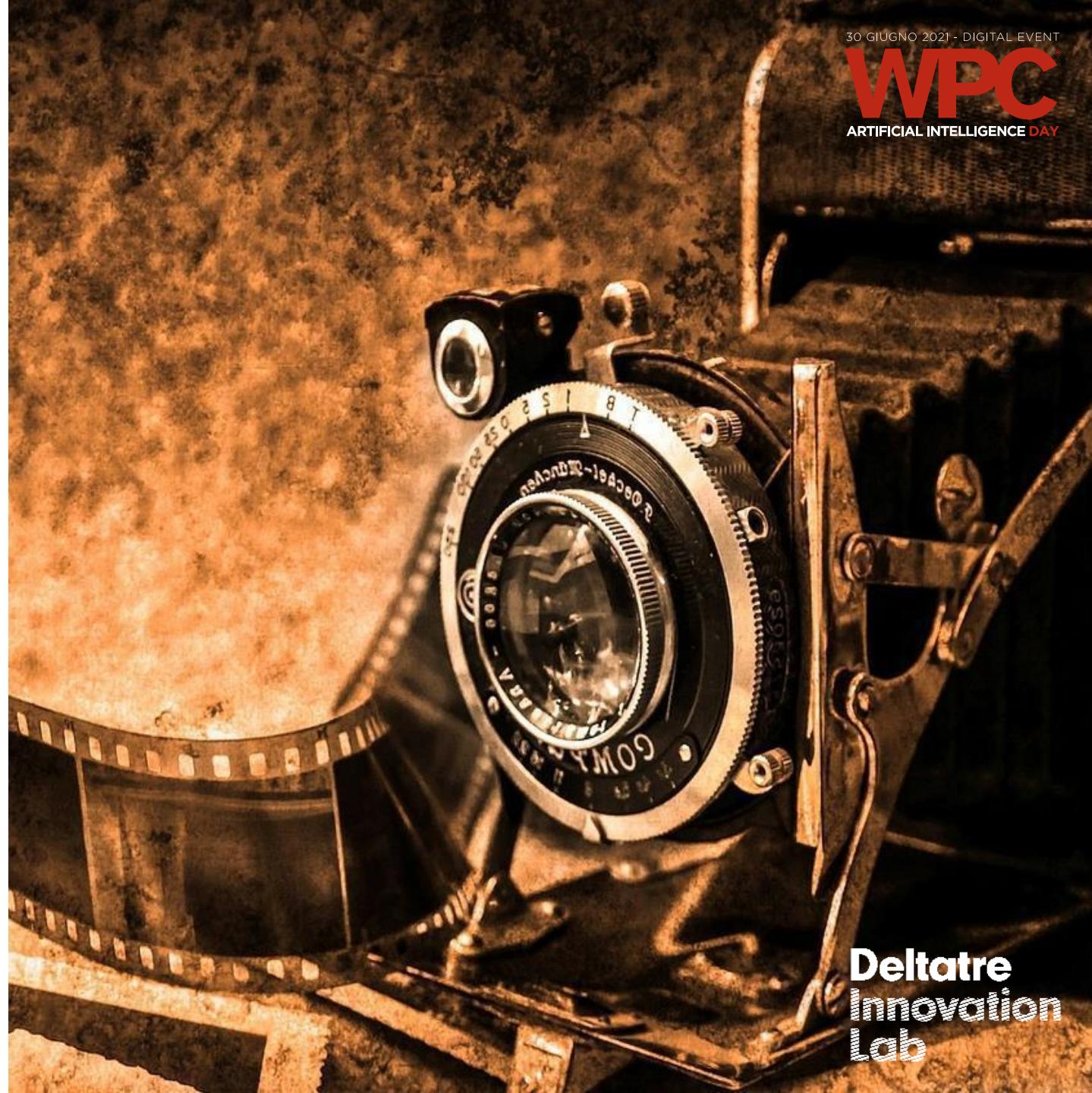
GitHub Repository

<https://github.com/deltatrelabs/deltatre-wpc-ai-2021-demo>

Demo Python Scripts
Slides

Video Restoration

- Increase resolution
- Increase frame rate
- Remove noise / artifacts
- Deblurring
- Repair damages
- Inpainting
- Watermarks removal
- Colorization



HI-DEF IMAGE

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WPC
ARTIFICIAL INTELLIGENCE DAY



OverNet
EDUCATION

Deltatre
Innovation
Lab

LOW-RES IMAGE



ARTIFACTS



BLURRED



DAMAGED



NOISE

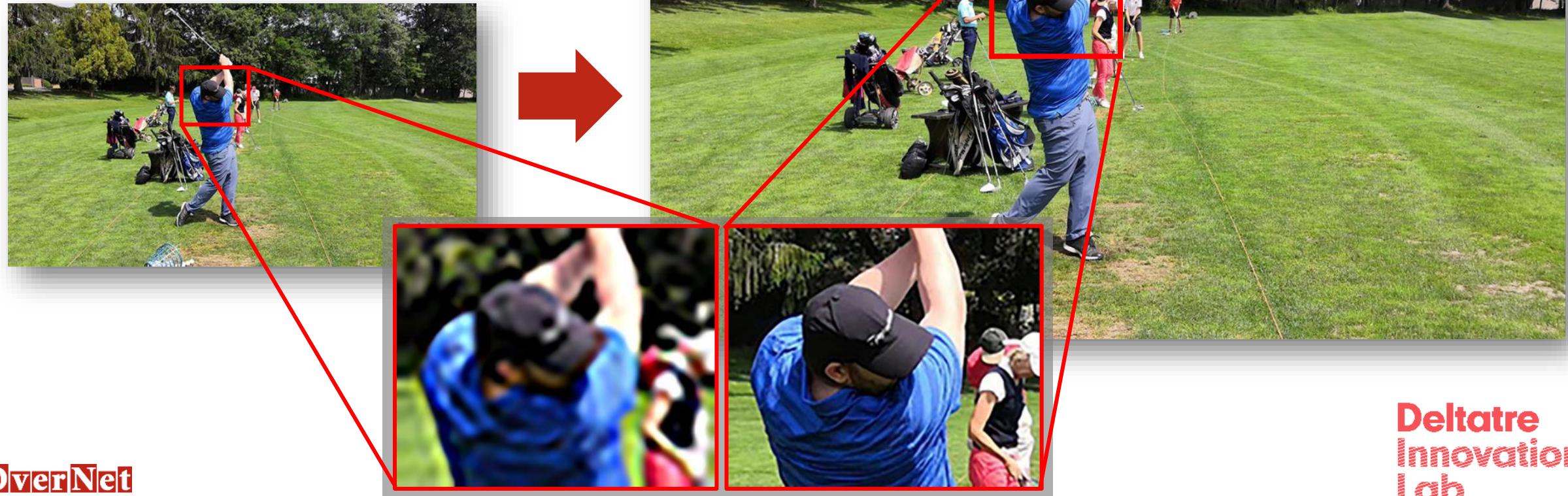


OLD ARCHIVE



Super-Resolution

The process of **upscaleing**
and/or **improving** the details
within an image



Video Interpolation

Given two consecutive frames, video interpolation aims at **generating intermediate frame(s)** to form both spatially and temporally coherent video sequences.

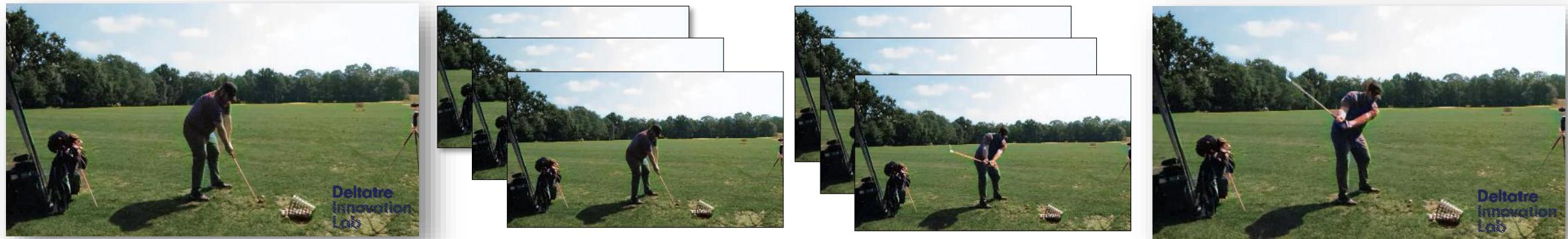


- Create slow-motion video from 'standard' footage
- Increase frame rate for smoother playback

Video Interpolation

Super SloMo: High Quality Estimation of Multiple Intermediate Frames for Video Interpolation

Huaizu Jiang, Deqing Sun, Varun Jampani, Ming-Hsuan Yang, Erik Learned-Miller, Jan Kautz (CVPR , 2018)



<https://news.developer.nvidia.com/transforming-standard-video-into-slow-motion-with-ai/>

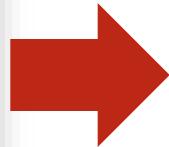
<https://developer.nvidia.com/rtx/ngx>

<https://people.cs.umass.edu/~hzjiang/projects/superslomo/>

<https://github.com/avinashpaliwal/Super-SloMo>

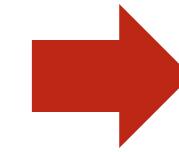
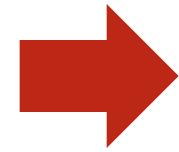
Colorization

Deep Learning-based **image colorization**, to transform grayscale to (*realistically plausible*) color images



It can be applied to **video content**, too!

Colorization



Colorization

State-of-the-art models from open-source project

DeOldify by Jason Antic

<https://github.com/jantic/DeOldify>

Leverages **fast.ai library** for state-of-the-art techniques, models and optimizations

<https://www.fast.ai/>

Automated Video Indexing

Text/Graphics OCR

Faces/Logos detection

Faces/Logos recognition

Content auto-tagging

(objects, people, places,
actions, etc.)

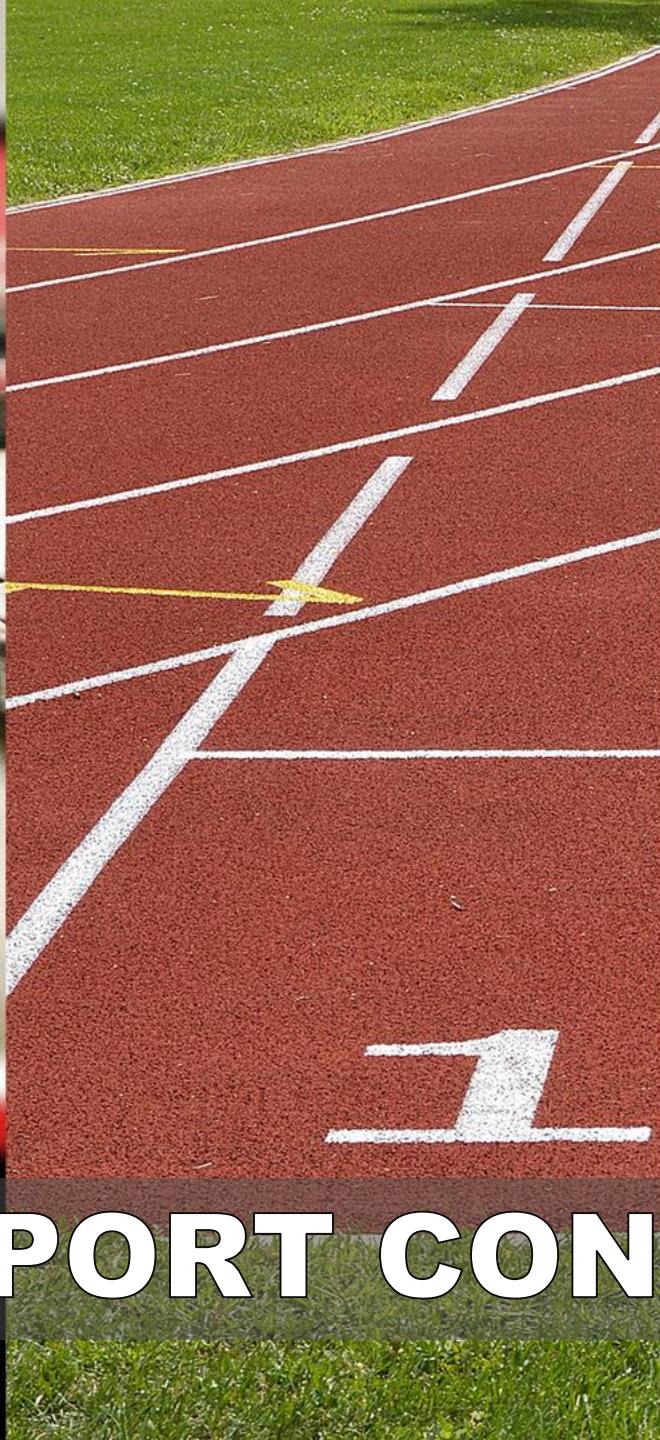
Camera detection

Emotion analysis

Automatic Highlights

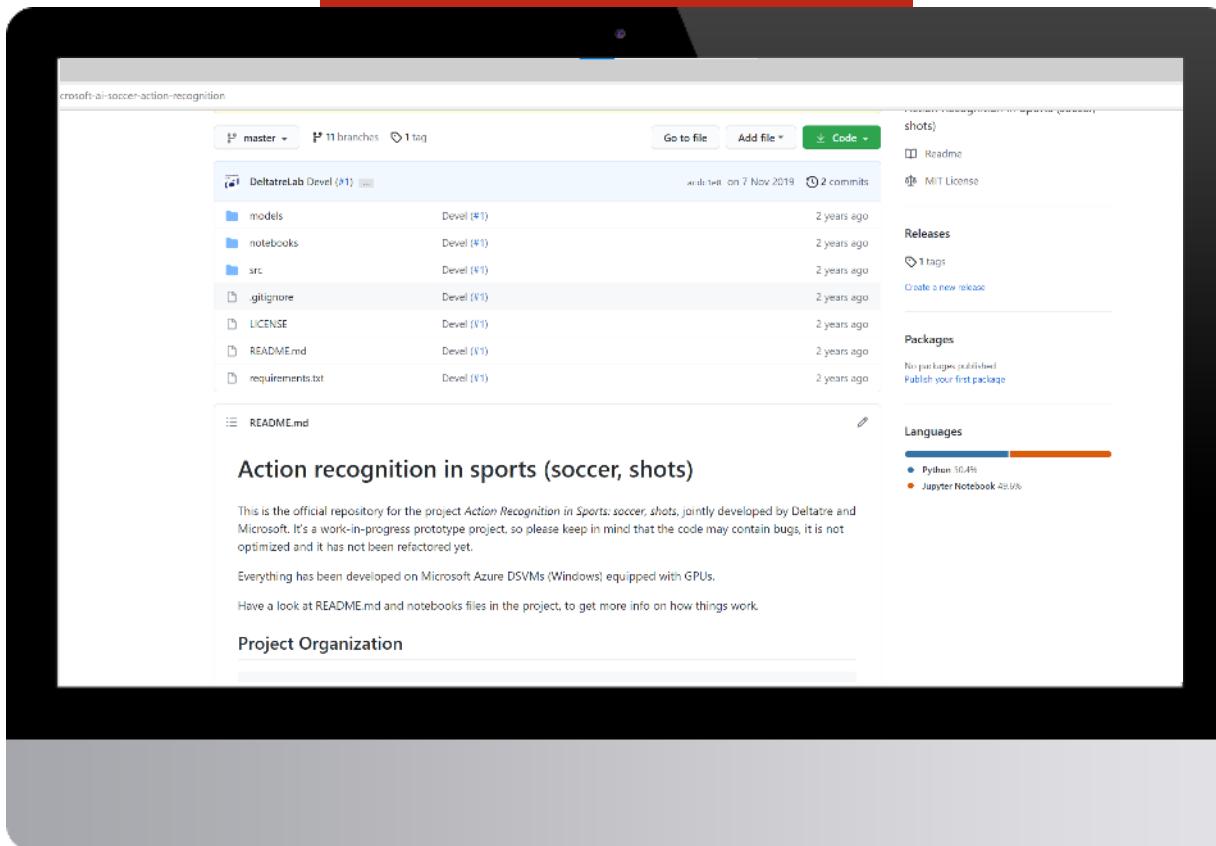
Smart sub-clipping





SPORT CONTENT INDEXING

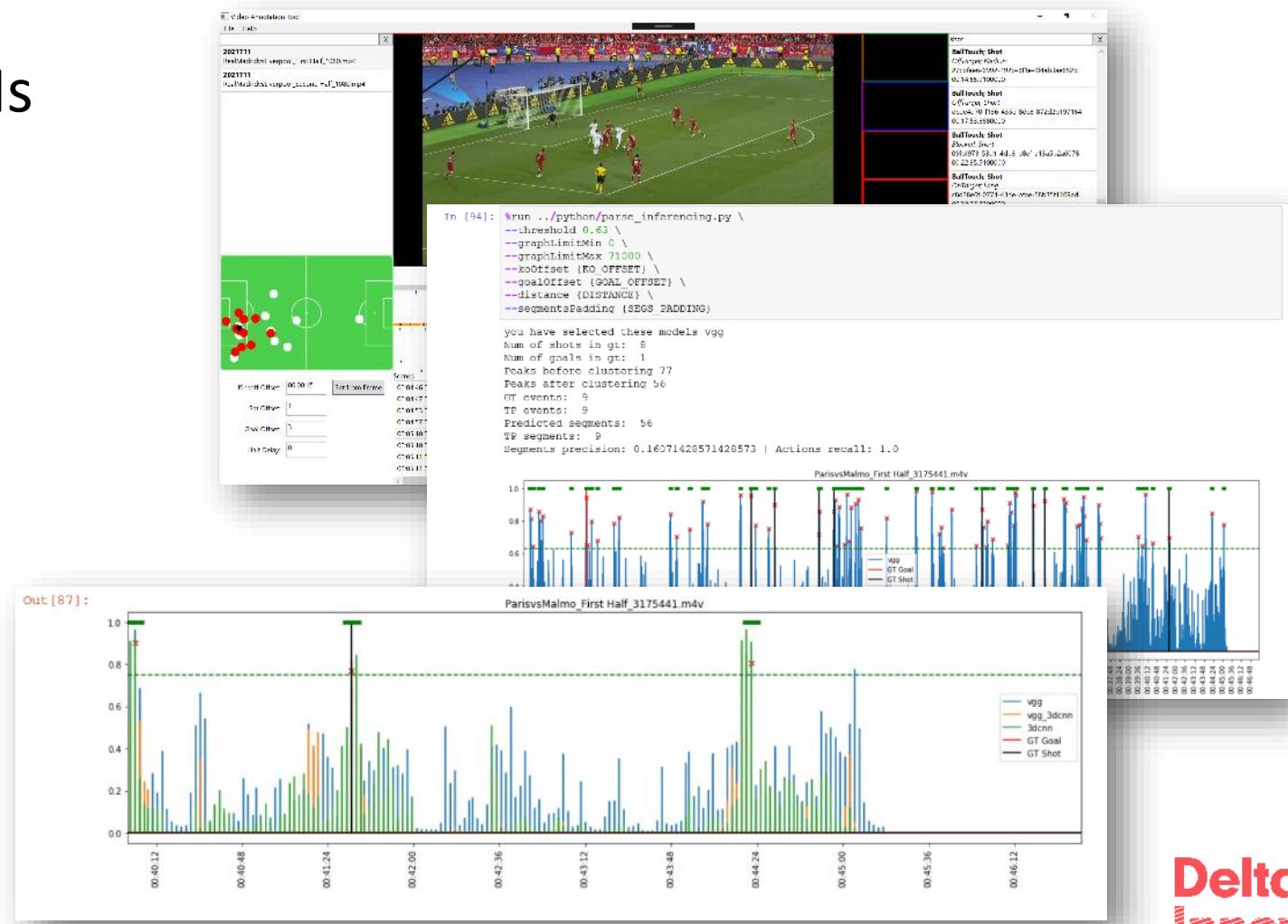
ACTION: SHOT ON GOAL



Demo: Action Recognition

Tools

Microsoft Azure DSVMs
 Visual Studio 2019
 Visual Studio Code
 PyCharm
 .NET ad-hoc tools
 Python scripts
 Jupyter notebooks



Dataset

A lot of videos (750)

45' video ~ 800MB

whole dataset ~ 600GB

Storage, bandwidth, processing power

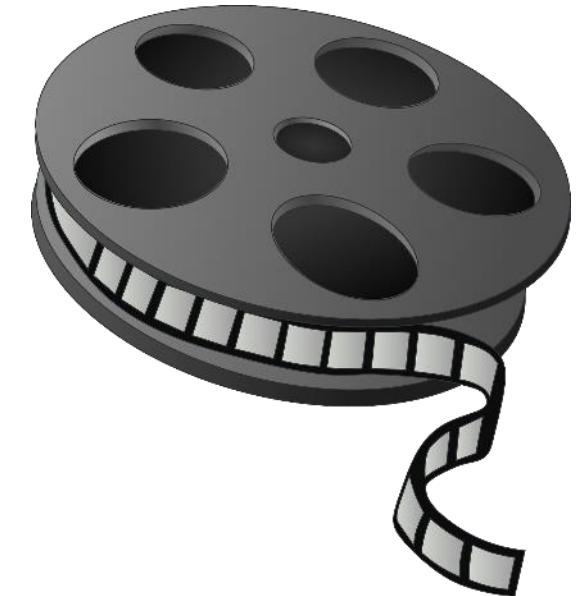
Metadata for *each* video

1 video ~ 10MB

whole dataset ~ 8GB

Blob storage → Premium SSD disk

DSVMs with attached (shared) disk



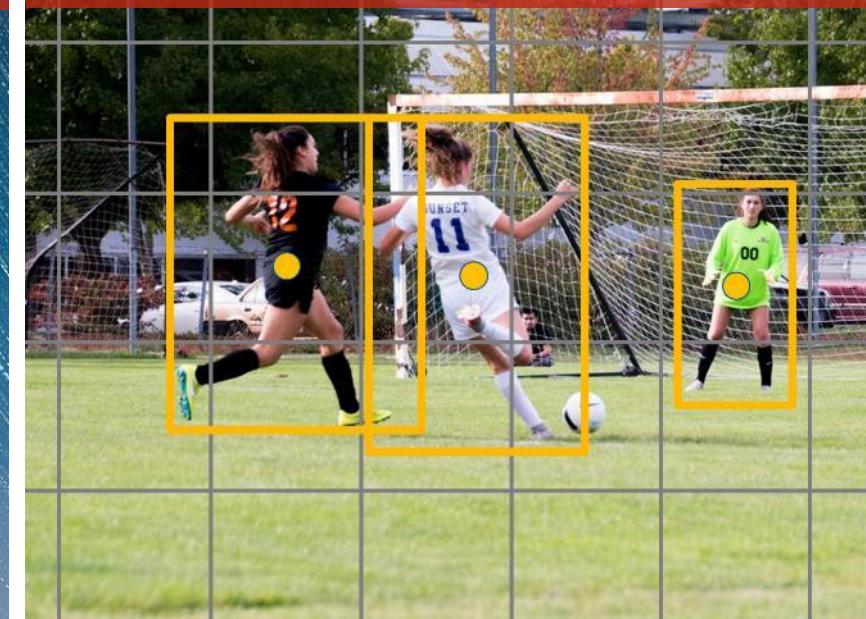
AMBIENCE/CROWD



SPEED/DIRECTION



PLAYER DENSITY



GOAL NET VISIBILITY



PLAYER POSES



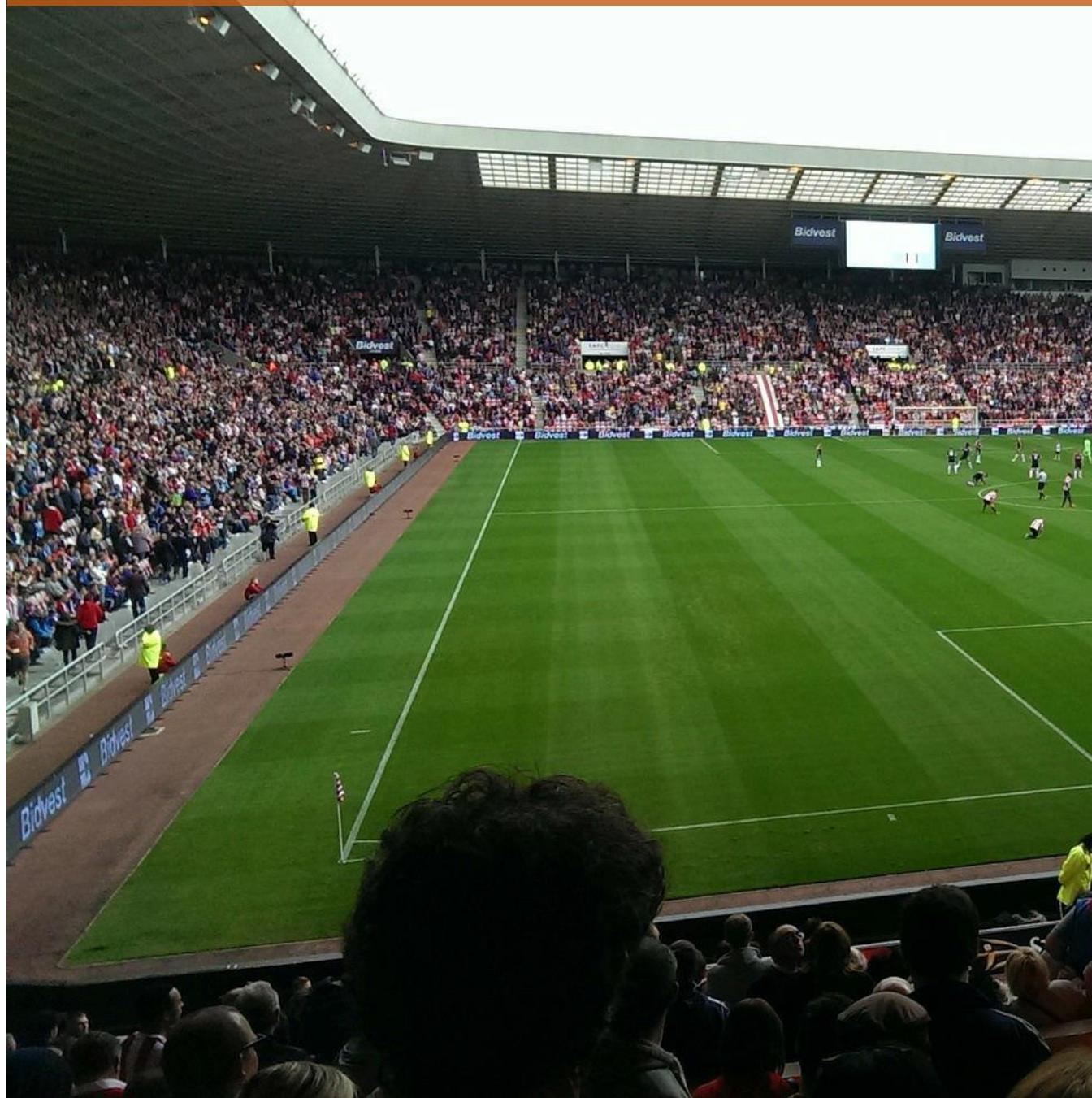
SCENE CHANGES

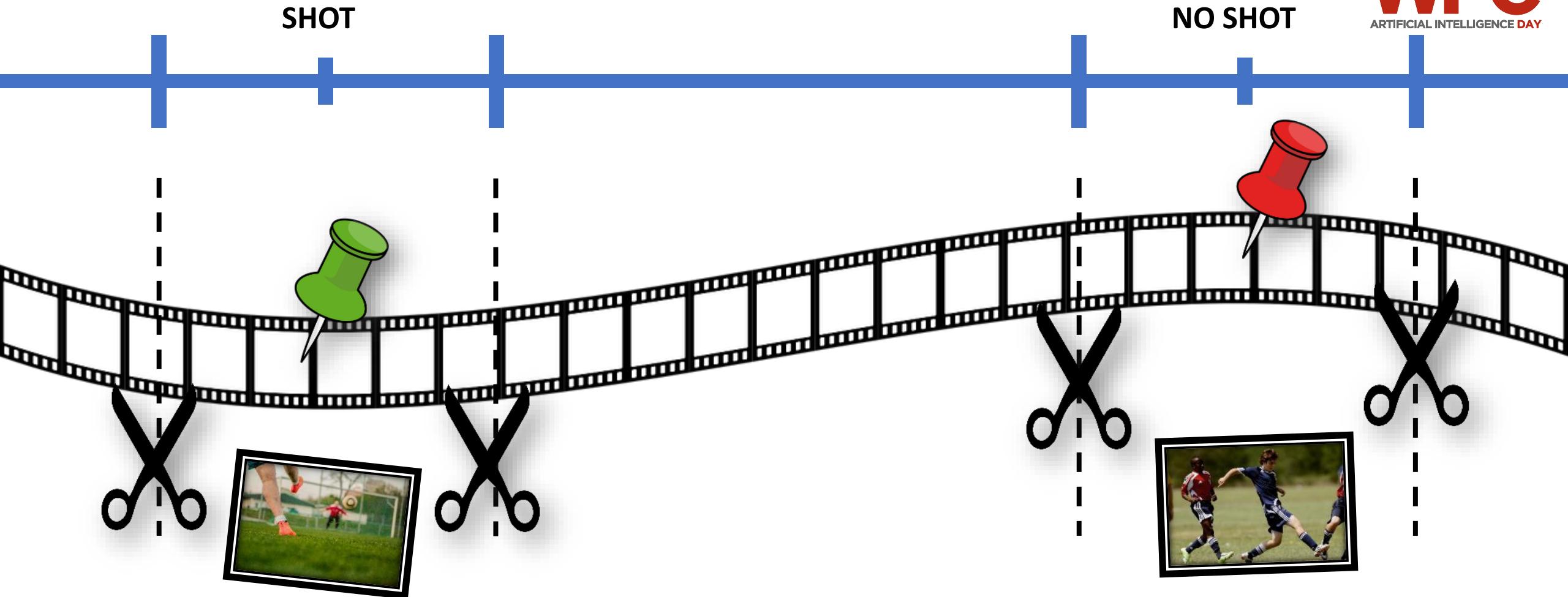


GOAL NET VISIBILITY



NEGATIVE SAMPLING





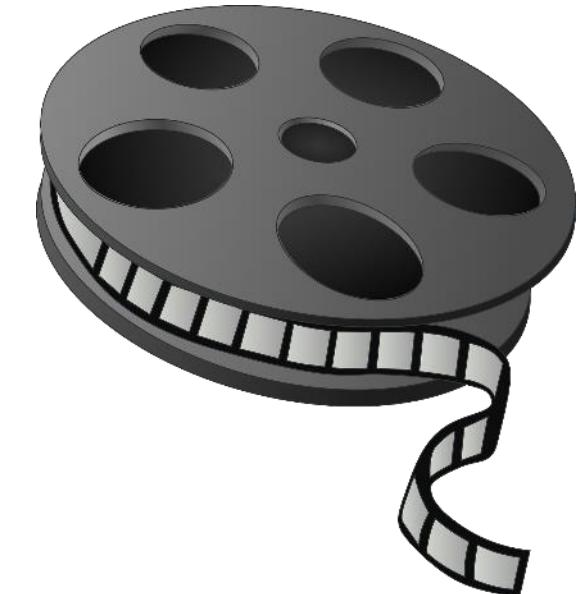
5s CLIPS - AROUND ACTION

Binary Classification Dataset

Extracted clips (~ 9000 x 2 classes)

5" length ~ 2MB

whole dataset ~ 32GB

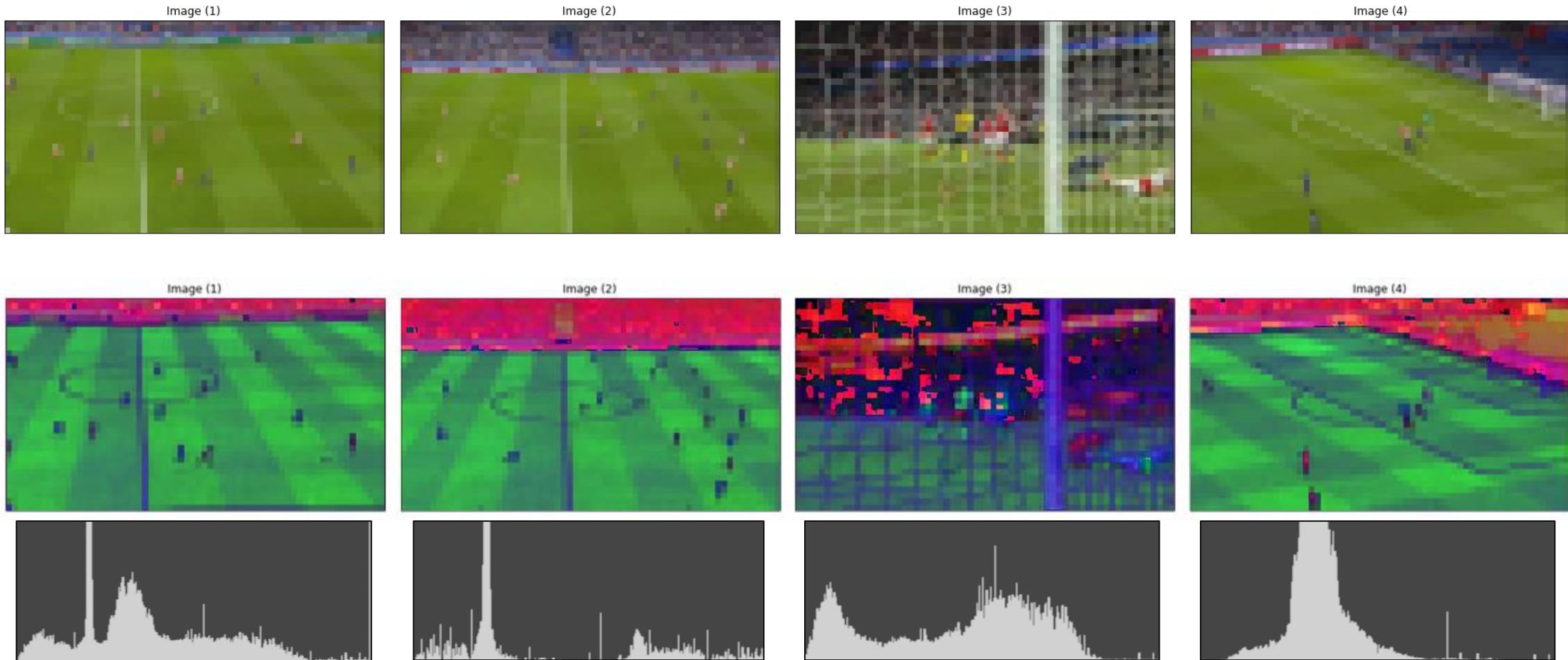


Intermediate results for each clip

Resize + Feature Extraction ~ 40MB

whole dataset ~ 720GB

Scene Change Detection



GitHub Repository

<https://github.com/deltatrelabs/deltatre-microsoft-ai-soccer-action-recognition>

Exploration Notebooks

PoC Python Scripts

Pre-trained Models

Thank You!

ευχαριστώ

Salamat Po

متشکرم

شکرًا

Grazie

благодаря

ありがとうございます

Kiitos

Teşekkürler

謝謝

ຂອບគ្មានគ្រែប

Obrigado

شكريه

Terima Kasih

Dziękuję

Hvala

Köszönöm

Tak

Dank u wel

дякую

Tack

Mulțumesc

спасибо

Danke

Cám ơn

Gracias

多謝晒

Ďakujem

תודה

ശ്രദ്ധി

Děkuji

감사합니다

About us



Clemente Giorio

R&D Senior Software Engineer @ **Deltatre**

- Augmented/Mixed/Virtual Reality
- Artificial Intelligence, Machine Learning, Deep Learning
- Internet of Things
- Embedded Apps
- Multimodal Tracking



INNOVATOR

[**PACKT**]
PUBLISHING Author

OverNet
EDUCATION



dotNET{podcast}



Deltatre
Innovation
Lab

About us



Ing. Gianni ROSA GALLINA

R&D Senior Software Engineer @ **Deltatre**



@giannirg

- AI, Machine Learning, Deep Learning on multimedia content
- Virtual/Augmented/Mixed Reality
- Immersive video streaming & 3D graphics for sport events
- Cloud solutions, web backends, serverless, video workflows
- Mobile apps dev (Windows / Android / Xamarin)
- End-to-end solutions with Microsoft Azure



<https://gianni.rosagallina.com/en/>



Questions?





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