

Applicazioni d'Intelligenza Artificiale su contenuti multimediali

Dalla sfera di cristallo al mondo reale

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Exploration

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

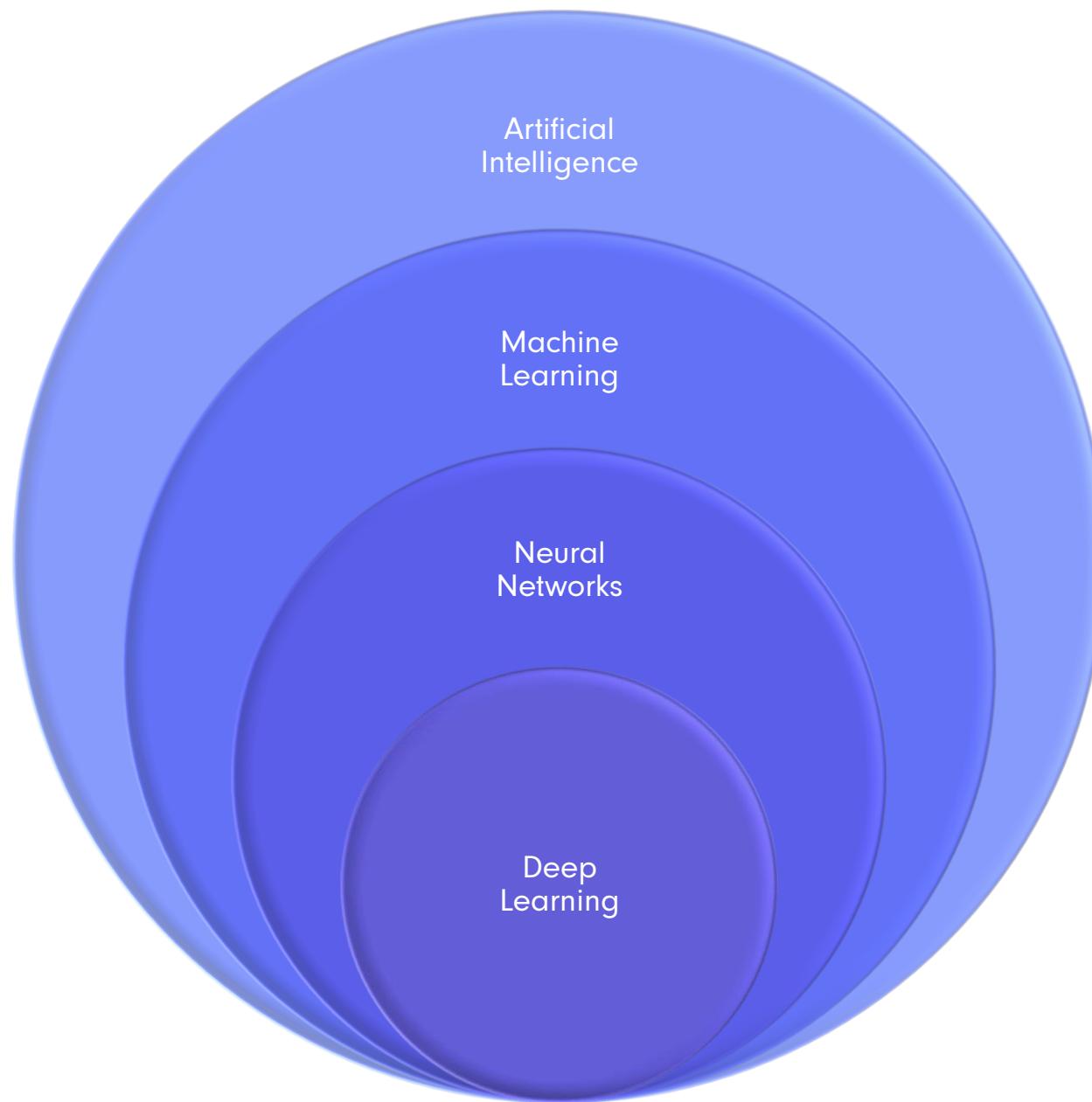
Engineering & MLOps

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

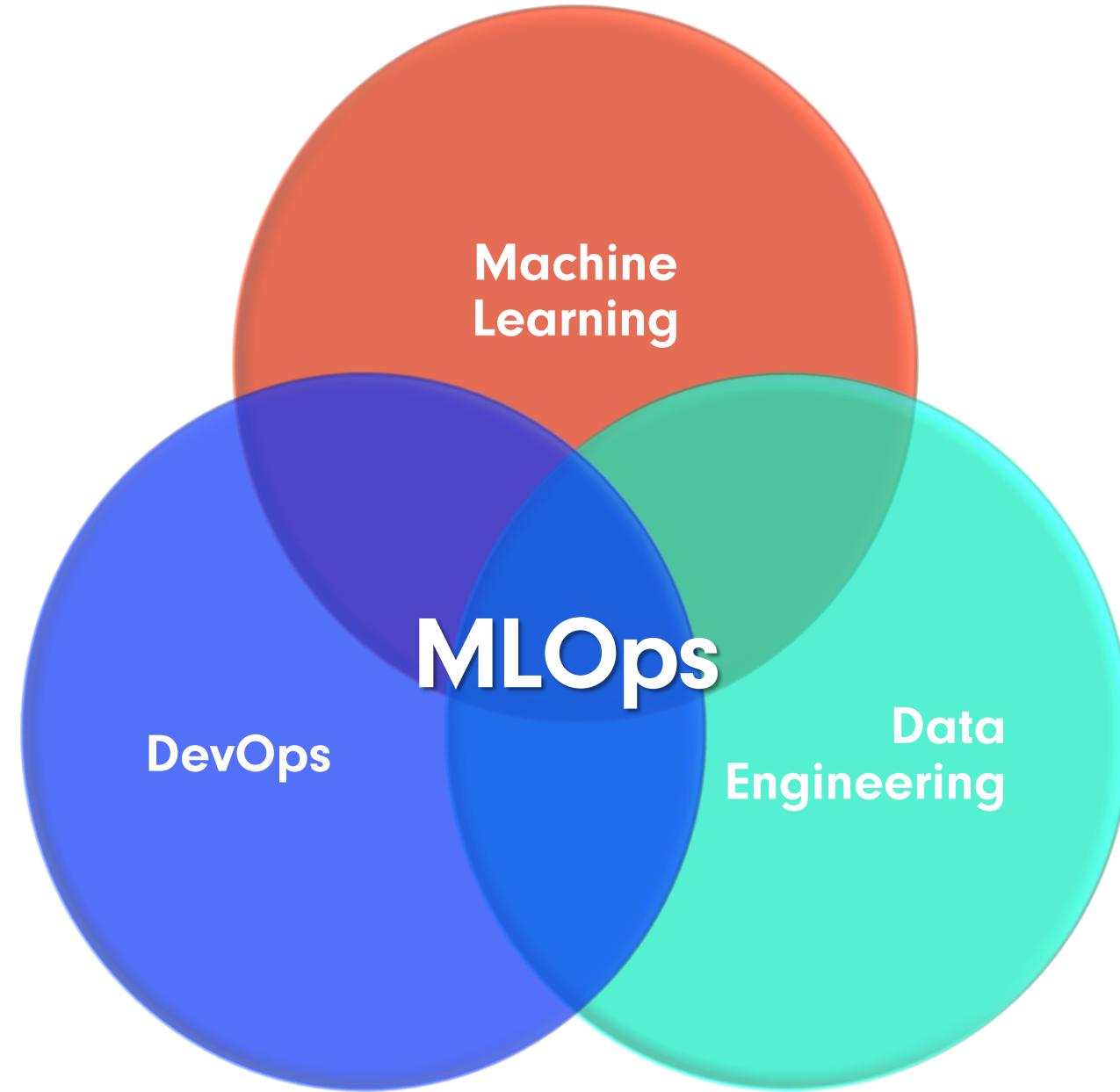
Production Ready

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

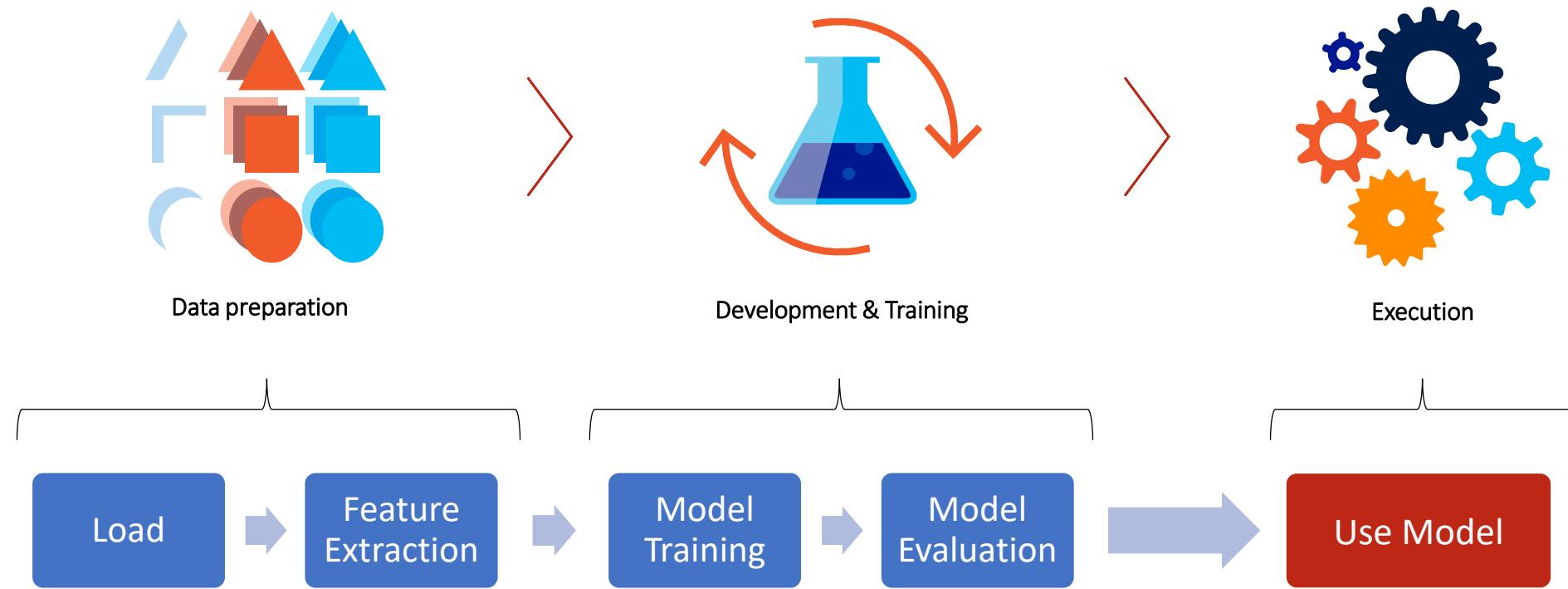
Artificial Intelligence



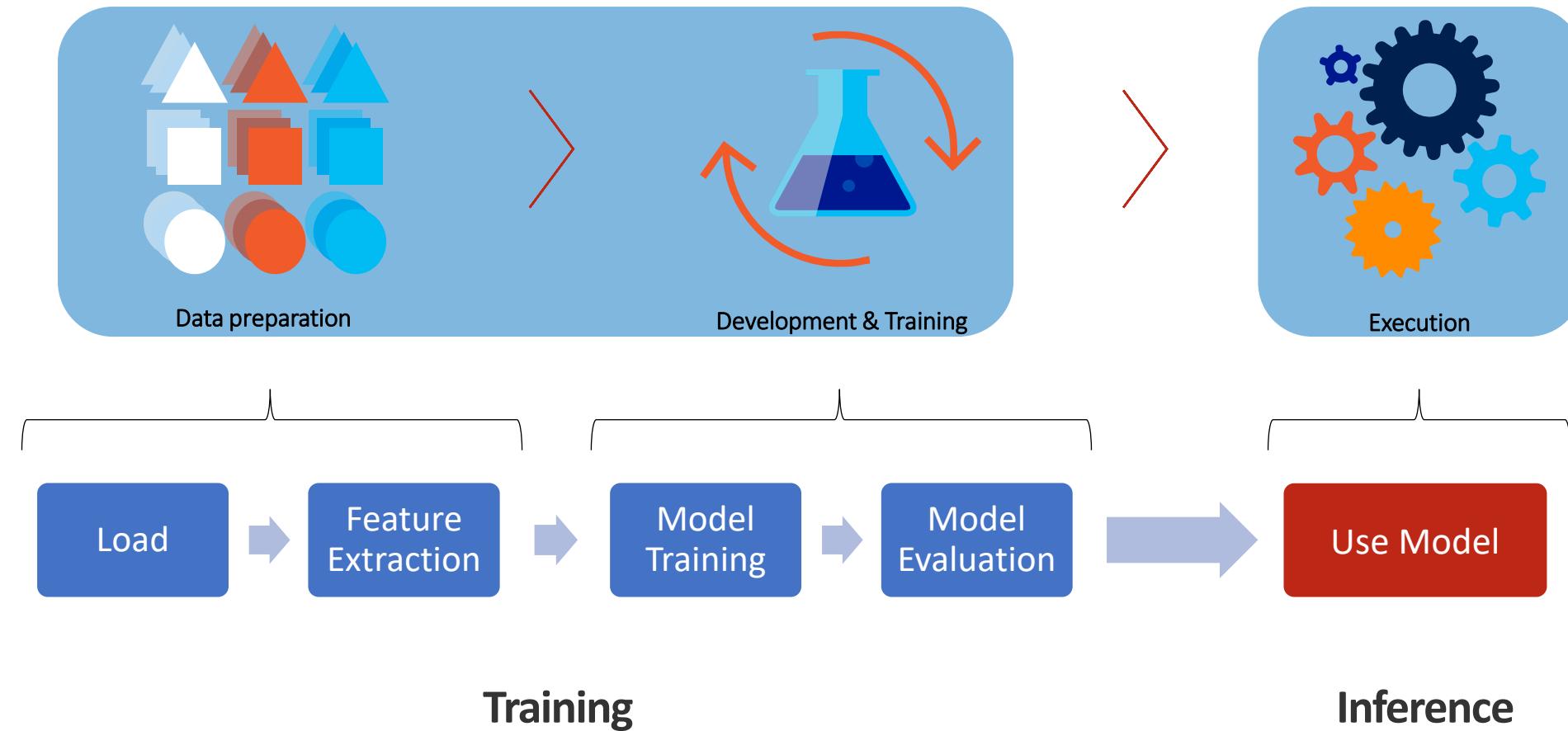
Artificial Intelligence



Typical ML Workflow



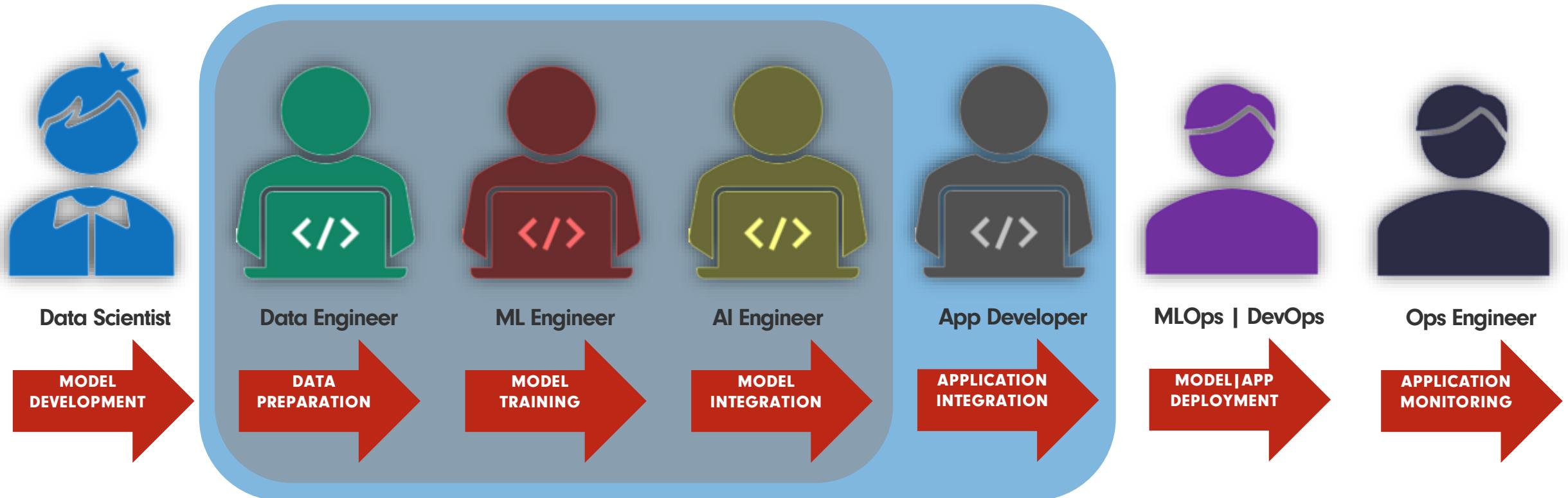
Training vs Inference/Scoring



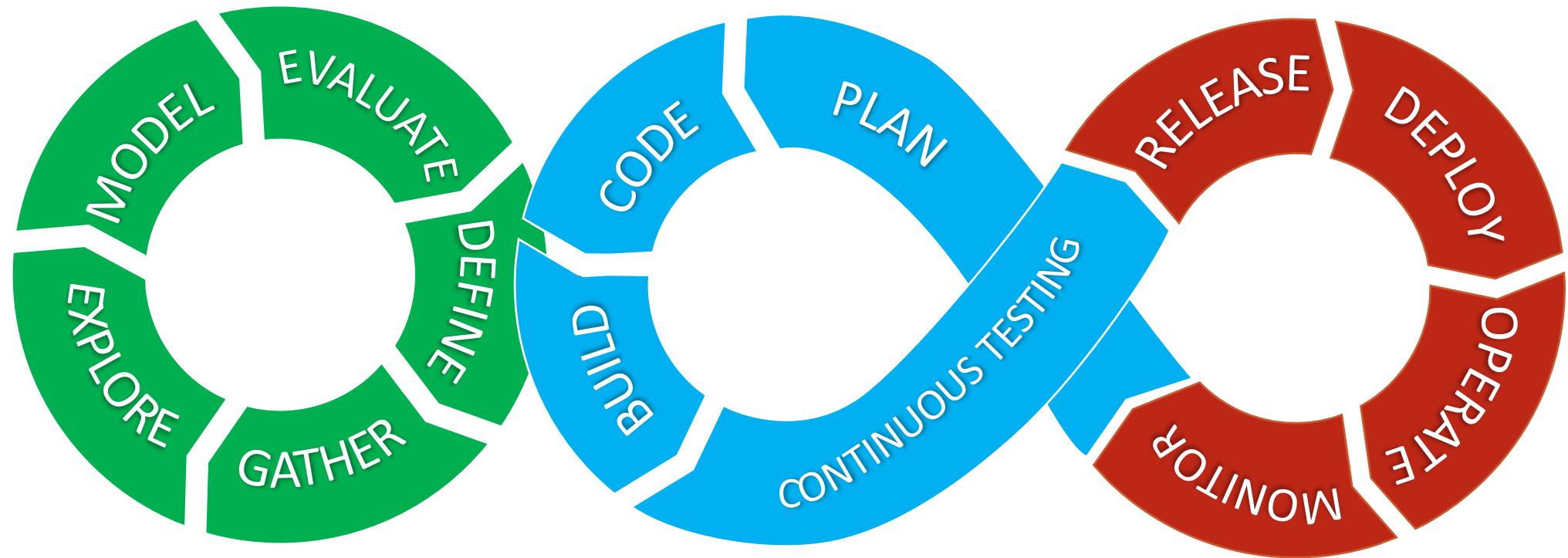
THE A-TEAM



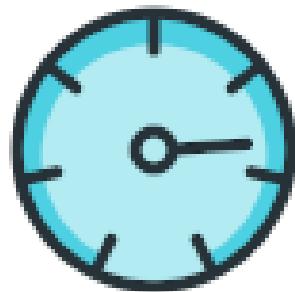
Typical ML Project Team



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

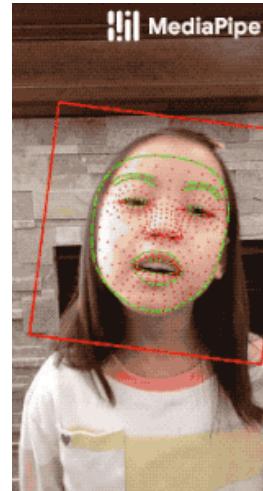


MediaPipe

Face Detection



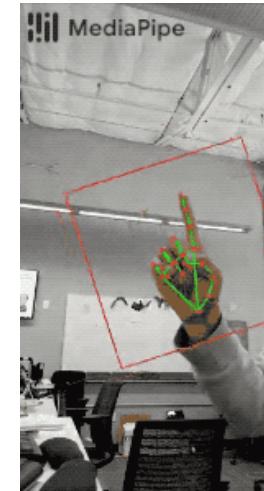
Face Mesh



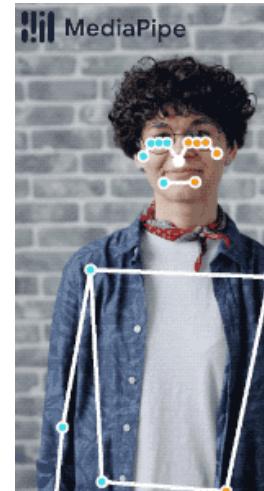
Iris



Hands



Pose



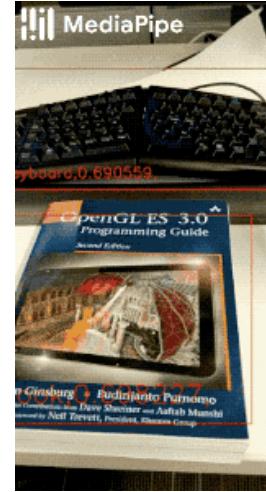
Holistic



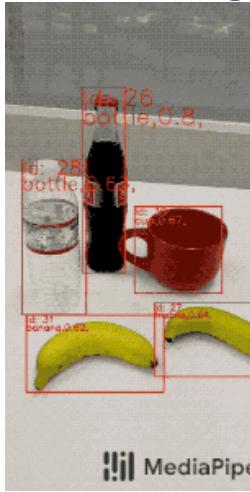
Hair Segmentation



Object Detection



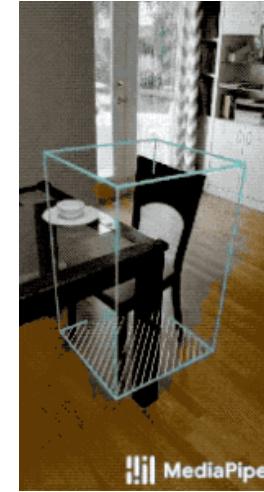
Box Tracking



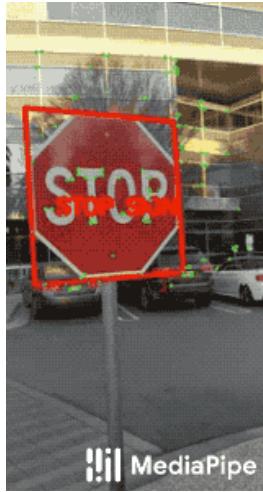
Instant M.T.

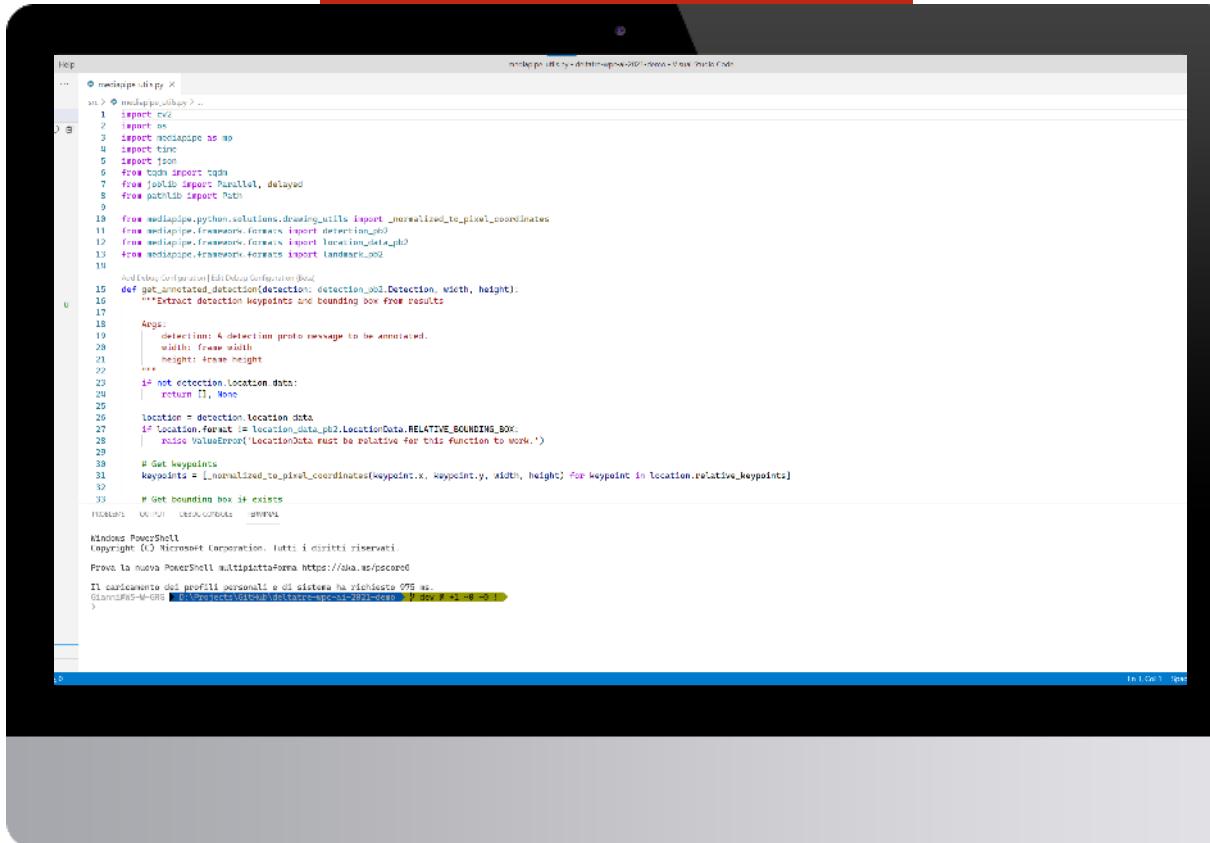


Objectron



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

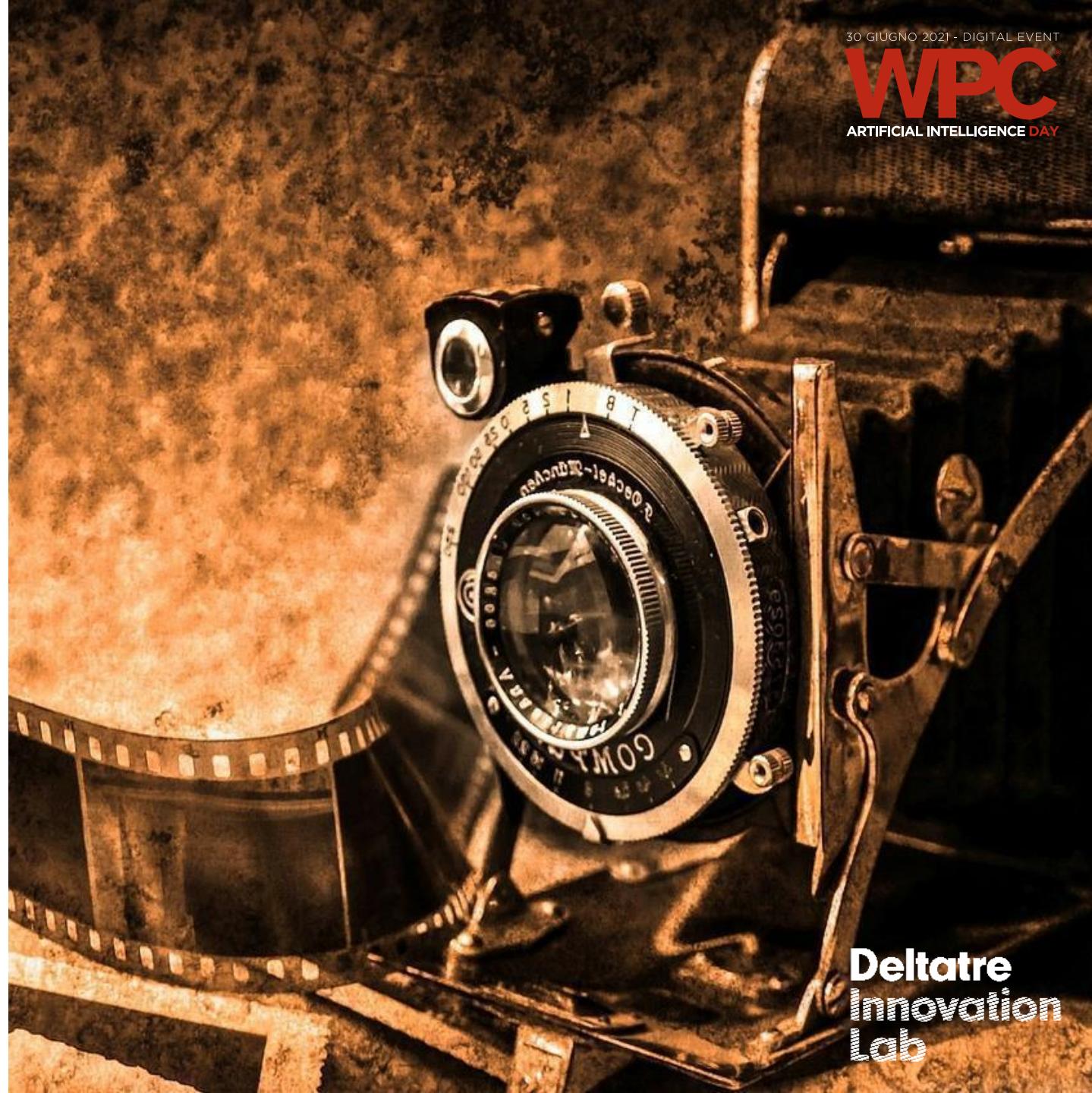
GitHub Repository

<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

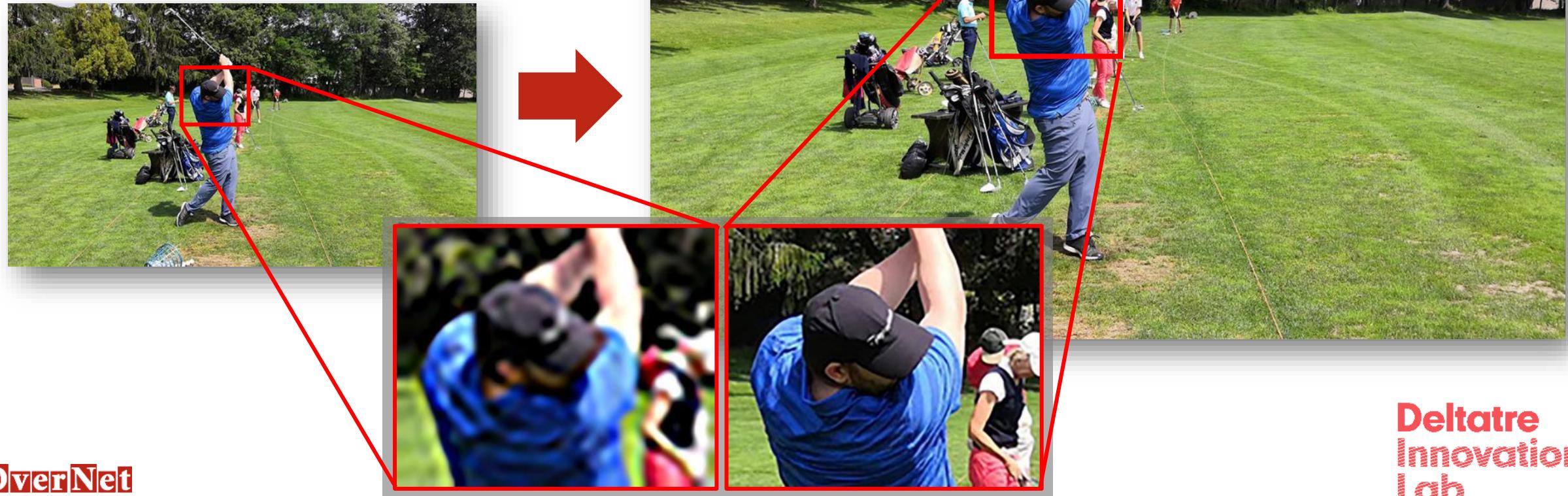


OLD ARCHIVE



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.

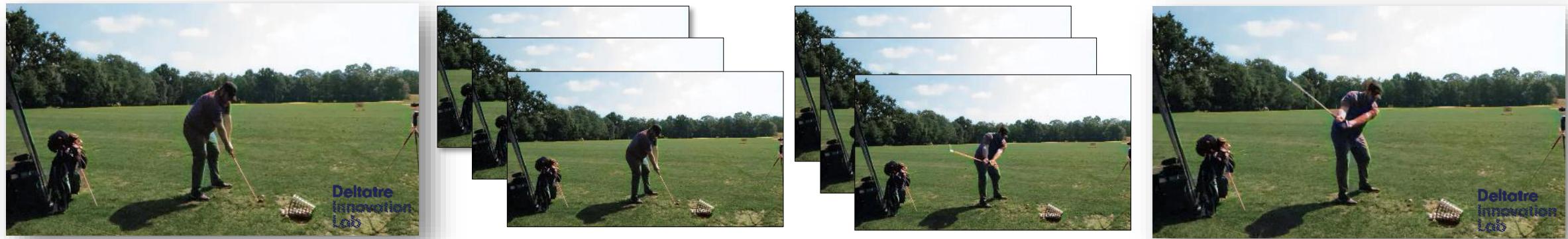


- Create slow-motion video from 'standard' footage
- Increase frame rate for smoother playback

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/>

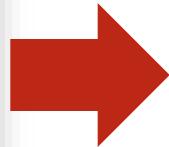
<https://developer.nvidia.com/rtx/ngx>

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

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

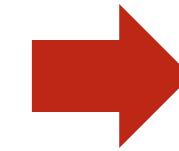
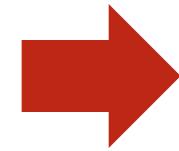
Colorization

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.)

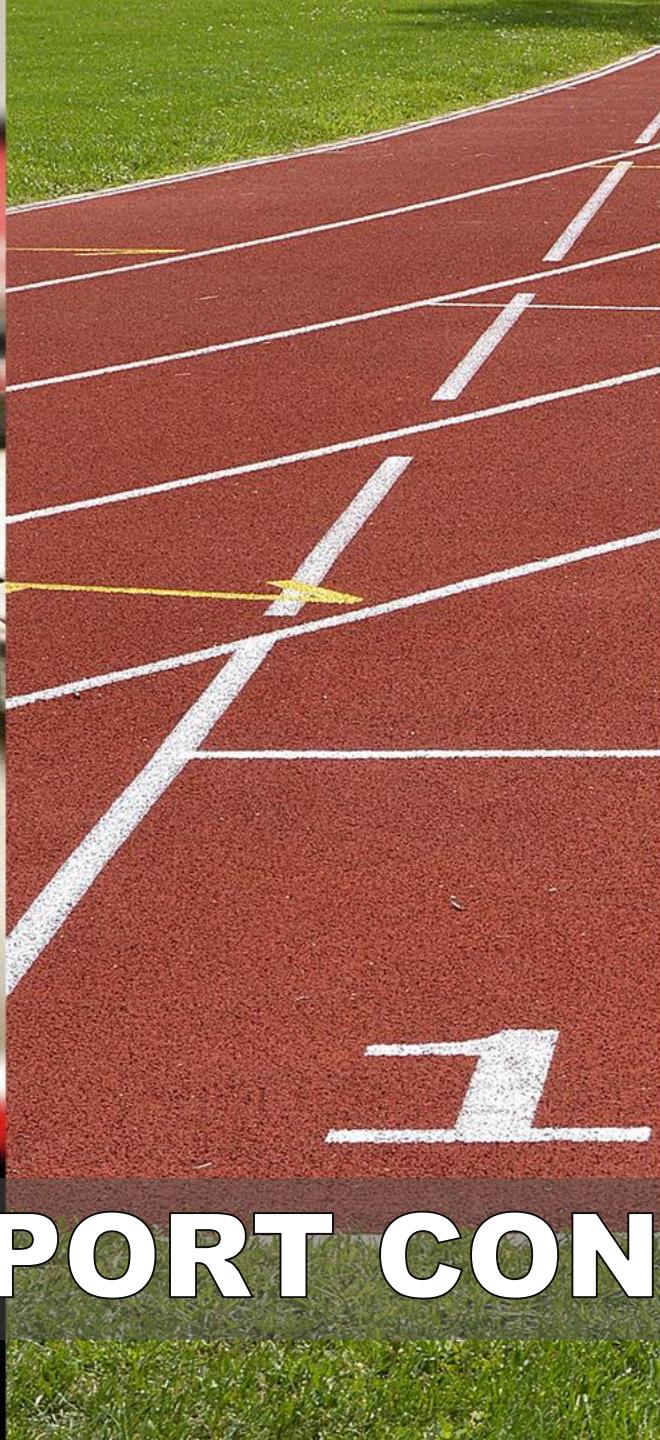
Camera detection

Emotion analysis

Automatic Highlights

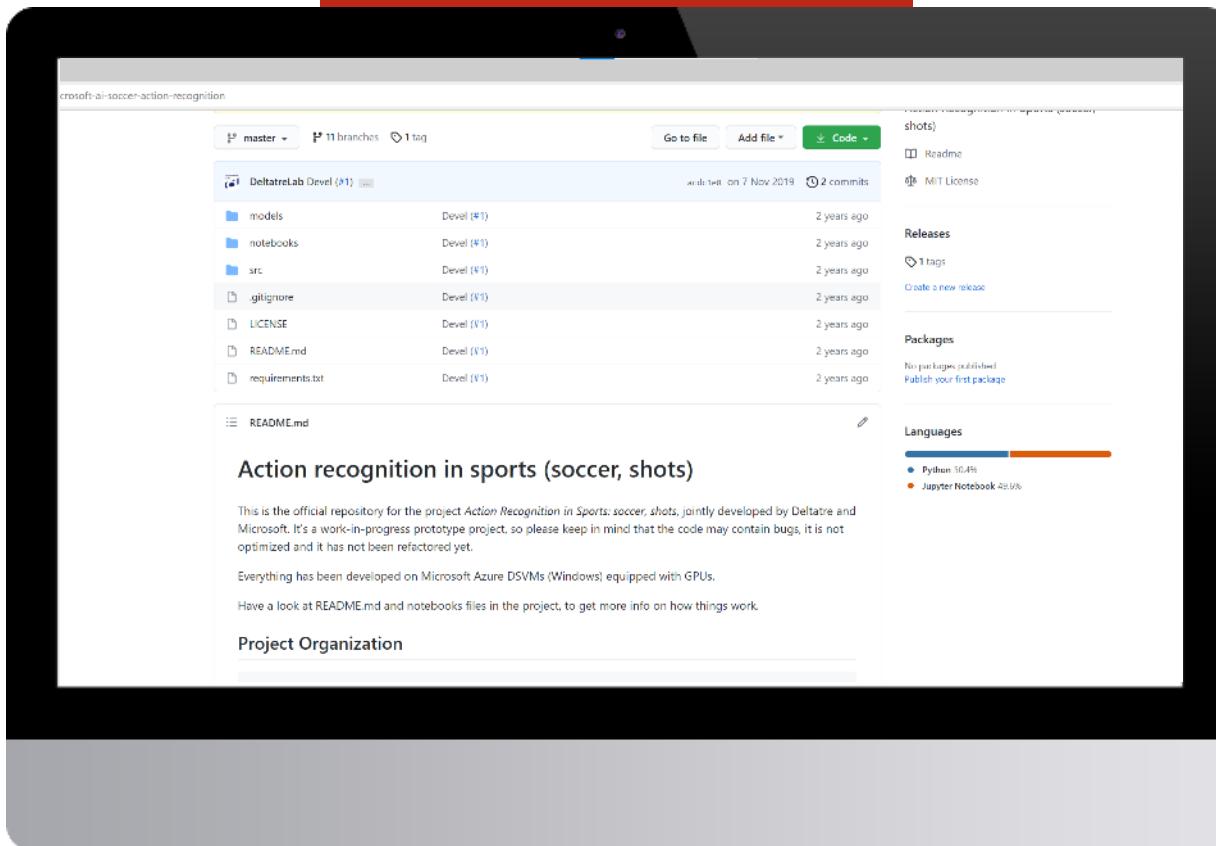
Smart sub-clipping





SPORT CONTENT INDEXING

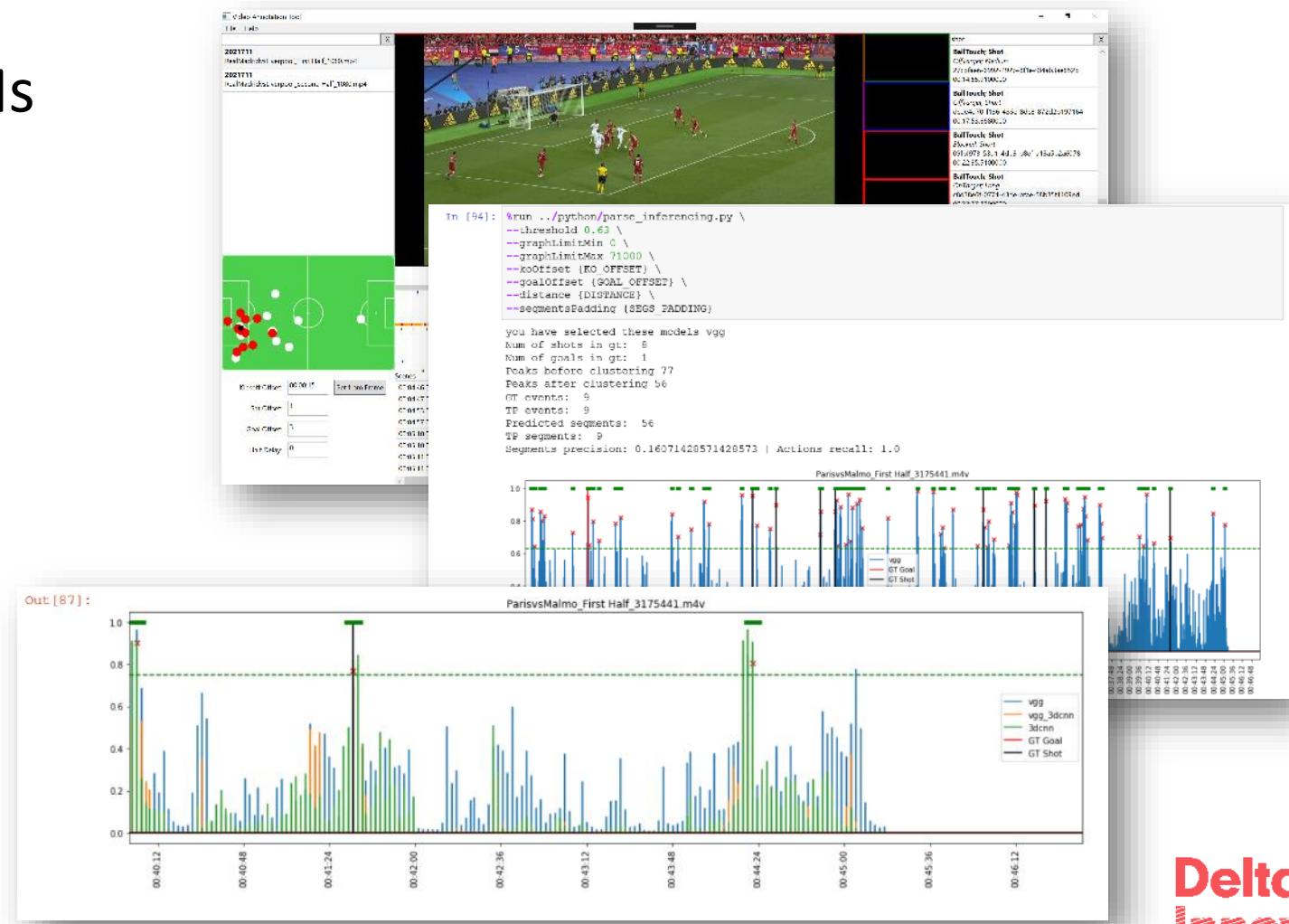
ACTION: SHOT ON GOAL



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



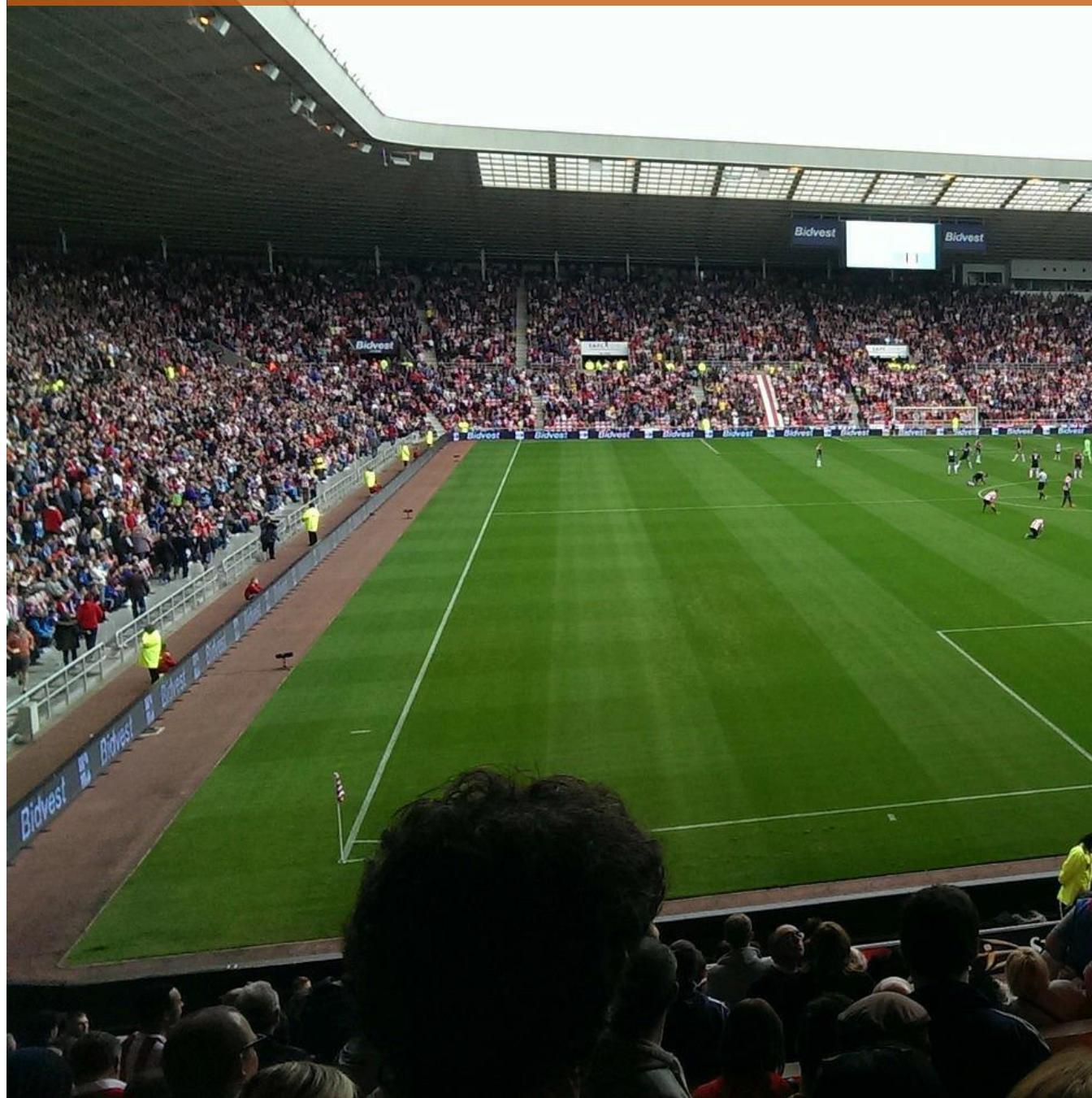
SCENE CHANGES

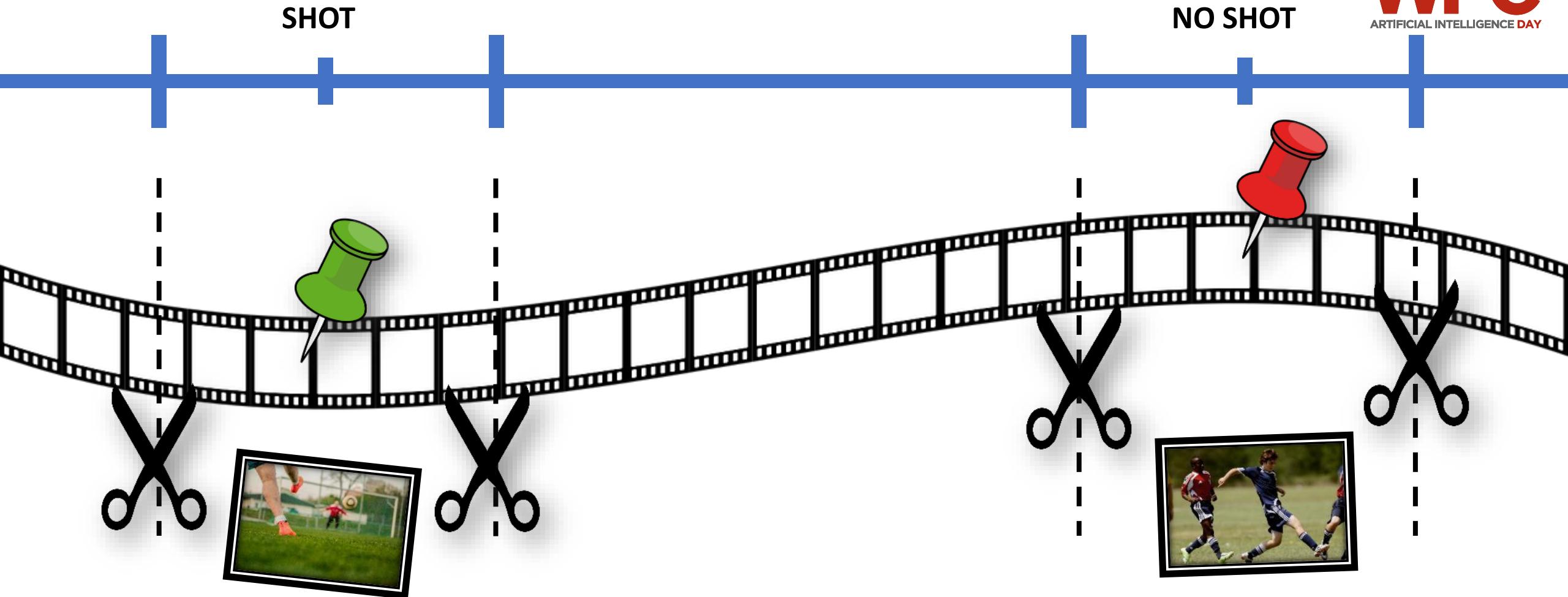


GOAL NET VISIBILITY



NEGATIVE SAMPLING





5s CLIPS - AROUND ACTION

Binary Classification Dataset

Extracted clips (~ 9000 x 2 classes)

5" length ~ 2MB

whole dataset ~ 32GB

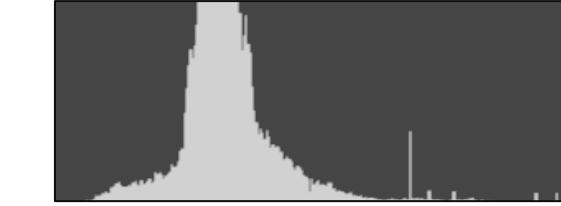
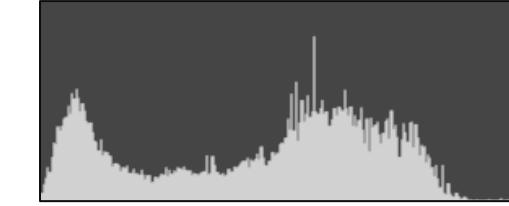
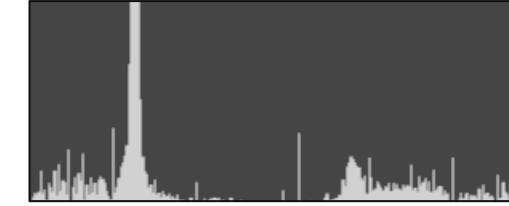
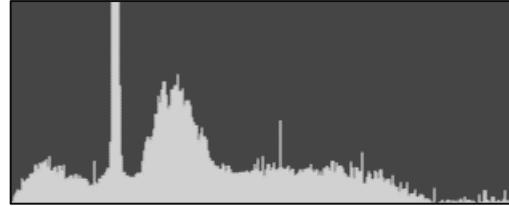
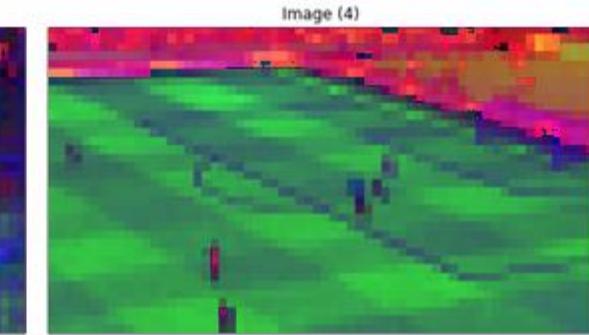
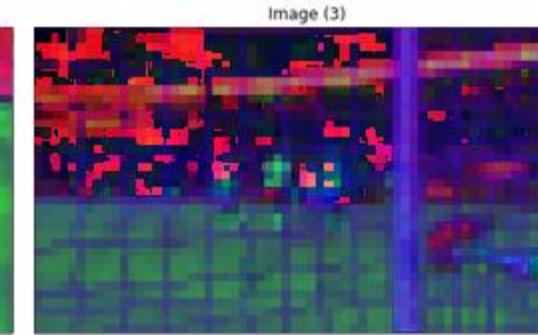
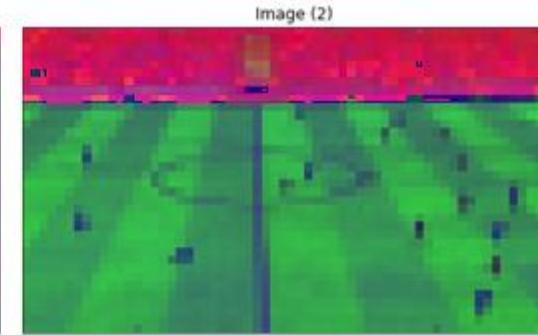
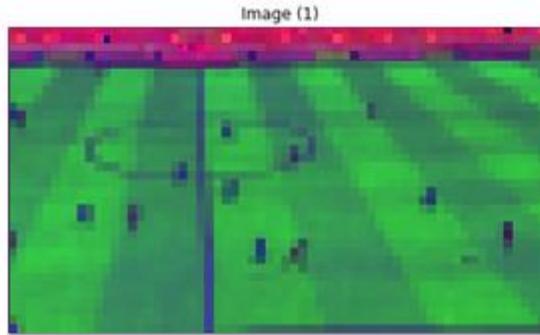
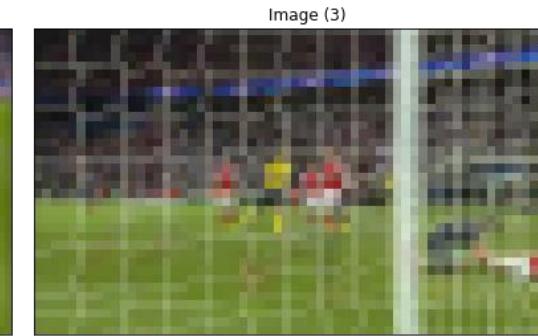


Intermediate results for each clip

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



PLURALSIGHT Author

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



Questions?





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