AI-H: The Artificial Intelligence Hub@PoliTo

September 29, 2021

Barbara Caputo

Artificial Intelligence
for Europe

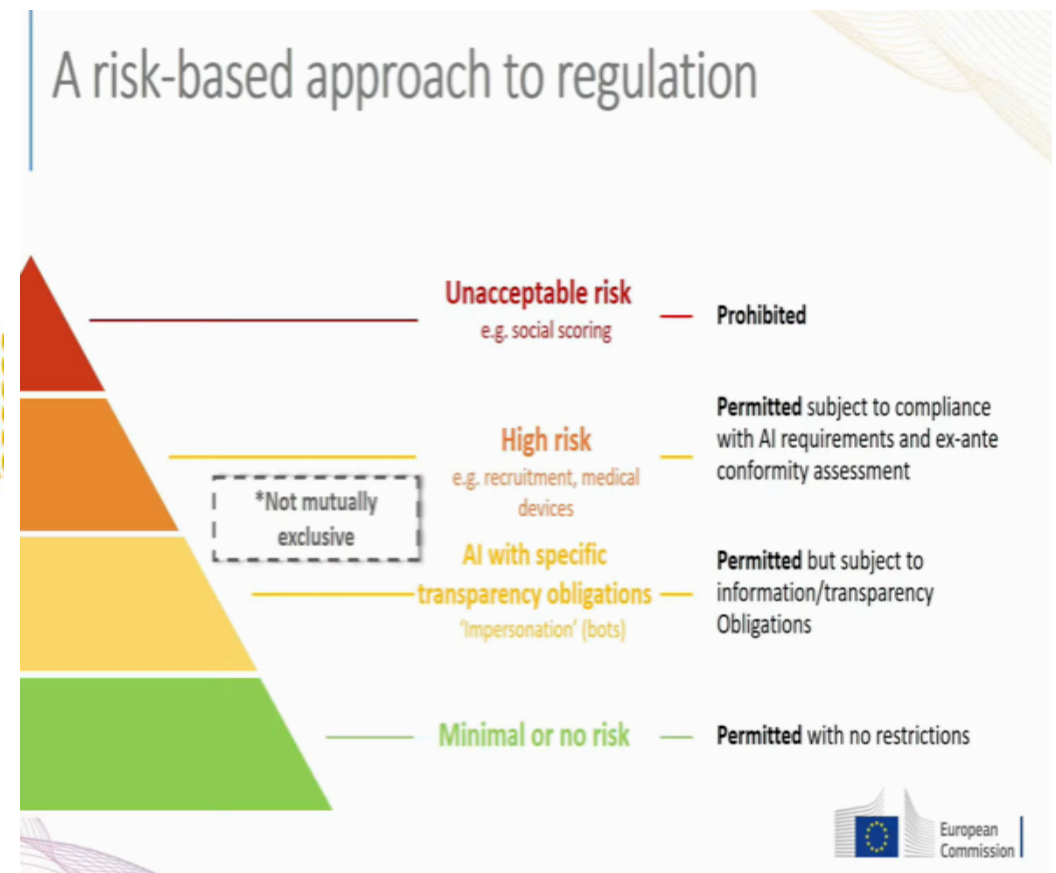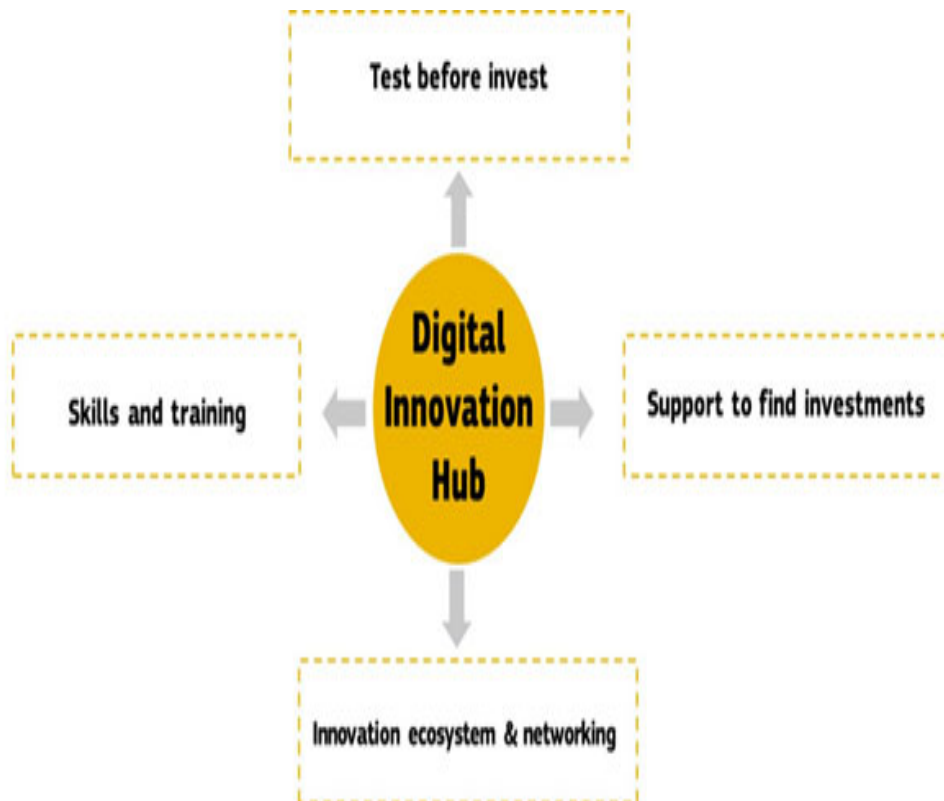Boost the EU's technological and industrial capacity and AI uptake across the economy

Prepare for socio-economic changes

Ensure an appropriate ethical and legal framework

#DigitalSingleMarket
#AI

AI in EU: initiatives

A risk-based approach to regulation

Unacceptable risk
e.g. social scoring — Prohibited

High risk
e.g. recruitment, medical devices — Permitted subject to compliance with AI requirements and ex-ante conformity assessment

*Not mutually exclusive

AI with specific transparency obligations
'Impersonation' (bots) — Permitted but subject to information/transparency Obligations

Minimal or no risk — Permitted with no restrictions

European Commission

EU funded initiatives: ELLIS

http://ellis.eu

- **Research**: ELLIS Programs & Fellows
- **Governance**: ELLIS society and membership
- **Infrastructure**: ELLIS Sites & Institutes
- **Training**: PhD Program

AI in Italy: vision & initiatives

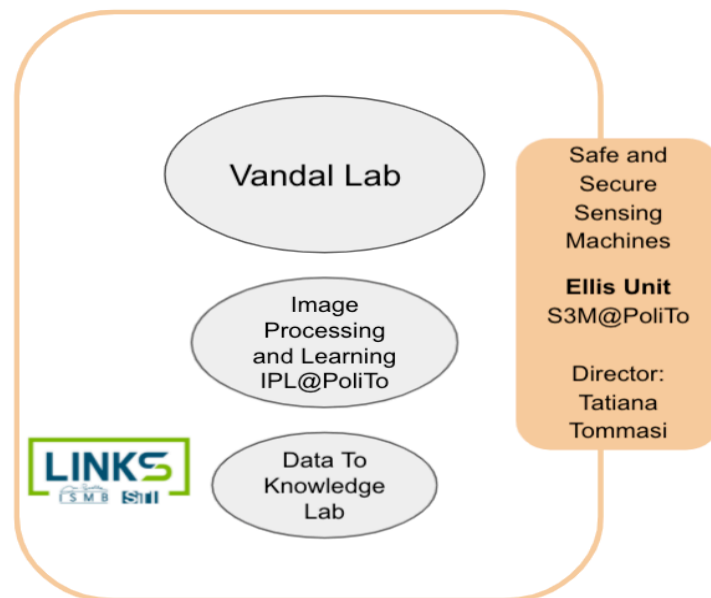Elaborata dal Gruppo di Esperti MISE sull'intelligenza artificiale

Proposte per una
Strategia italiana
per l'intelligenza artificiale

AI-H@PoliTO: Artificial Intelligence Hub

Vandal Lab

Image Processing and Learning IPL@PoliTo

LINKS
(SMB Srl)

Data To Knowledge Lab

Safe and Secure Sensing Machines

Ellis Unit
S3M@PoliTo

Director:
Tatiana Tommasi

e l l i s

AI-H@PoliTo, Hub on AI including 100+ faculties active on **foundational and applied AI**

- Best Public Business Incubator in the world as recognized by the World Rankings of Business Incubators and Accelerators 2019-2020 (**i3p.it**)
- Italian National PhD Programme in Artificial Intelligence (**PhD-AI.it**) ~15M€
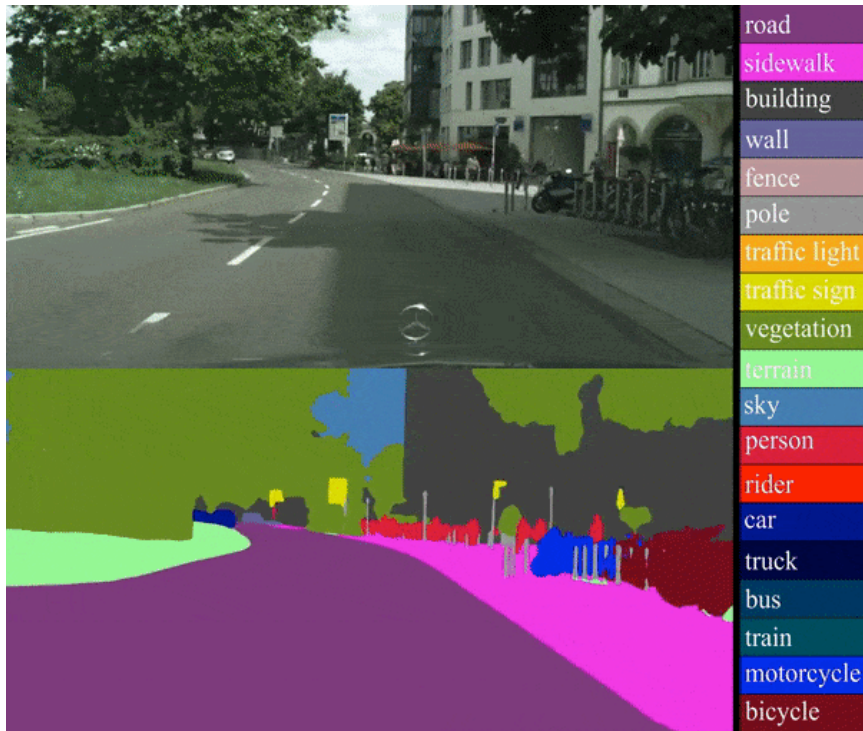
Semantic Segmentation

- Crucial for Autonomous Driving

- Extremely data hungry

- Sensitive to change in appearance (weather condition, light, rural / urban environment, camera point of view)

Semantic Segmentation

- Crucial for Autonomous Driving

- Extremely data hungry
  Train models on synthetic data

- Sensitive to change in appearance
  (weather condition, light, rural / urban
  environment, camera point of view)
  Solve domain adaptation

| DATASET	RELEASE	SIZE	RESOLUTION	FOV	IMAGES TYPE	CLASSES	TOWNS	WEATHERS	VIEWPOINTS
Real-World Dataset									
KITTI[3]	2012	400	1392x512	NA	RGB, Semantic, Depth	33	1 city (Karlsruhe)	1 weather	1 (car)
Cityscapes[5]	2016	25k	2048x1024	90°	RGB, Semantic	33	50 German cities	2 Weathers, 1 day time	1 (car)
Mapillary[2]	2017	25k	1920x1080	NA	RGB, Semantic	66	6 continents	5 weathers, 4 day-times	Multiple viewpoints
BDD100K[1]	2018	100k	1280x720	NA	RGB, Semantic, Bounding Box	40	2 cities, NY and SF	6 weathers, 3 day-times	Multiple viewpoints
ApolloScape[7]	2018	144k	3384x2710	NA	RGB, Semantic, Depth	25	1 Chinese city	3 day-times	1 (mid-sized SUV)
nuScenes[8]	2019	40k	1600x900	360°	RGB, Semantic, Bounding Box	23	2 cities (SGP and Boston)	3 weathers, 2 day-times	1 (car)
Synthetic Dataset									
SYNTHIA[9]	2012	220k	960x720	100°	RGB, Semantic, Depth	13	4 virtual cities	Multiple weathers	Multiple viewpoints
GTA V[4]	2016	25k	1914x1052	NA	RGB, Semantic	19	1 virtual city (LA)	3 weathers, 2 day-time	Multiple viewpoints
IDDA	2020	1M	1920x1080	90°	RGB, Sem, Depth	24	7 virtual cities	3 weathers	5 viewpoints

Currently under submission: IEEE International Conference on Intelligent Robots and Systems, 2020

Towards Multi-Source Adaptive Semantic Segmentation
P. Russo, T. Tommasi, B. Caputo,
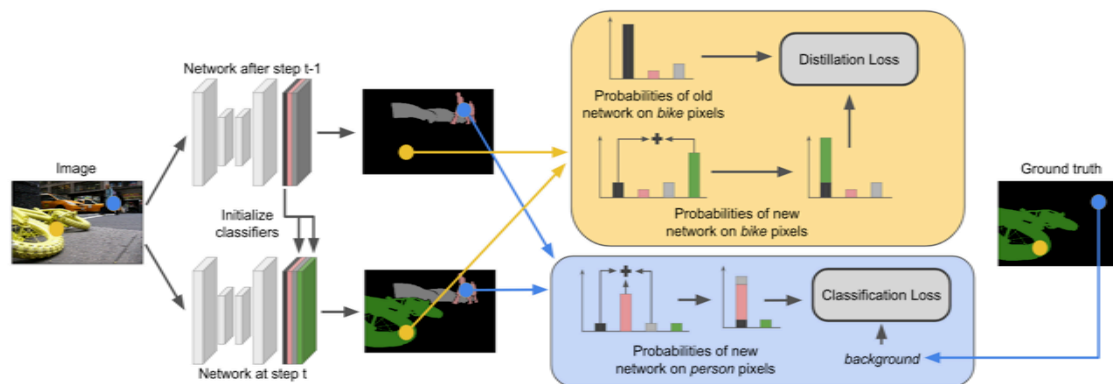International Conference on Image Analysis and Processing, 2019

Incremental Class Learning
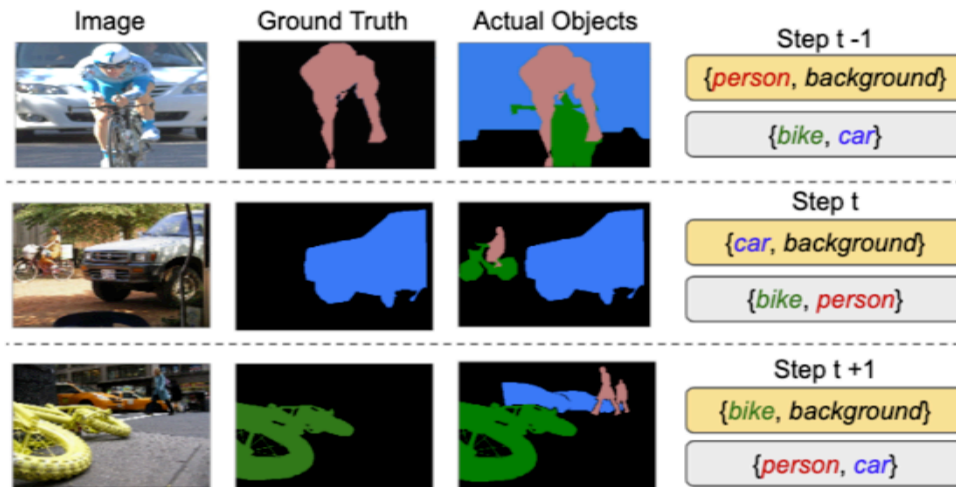
The background class definition may change in time during incremental class learning for semantic segmentation.
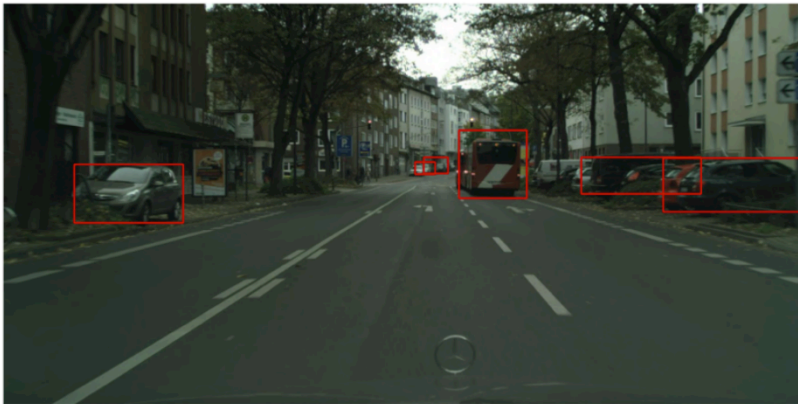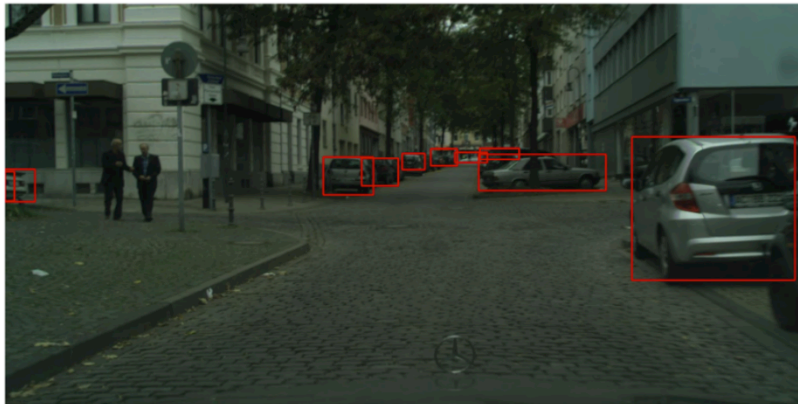
We proposed a method to tackle this issue.

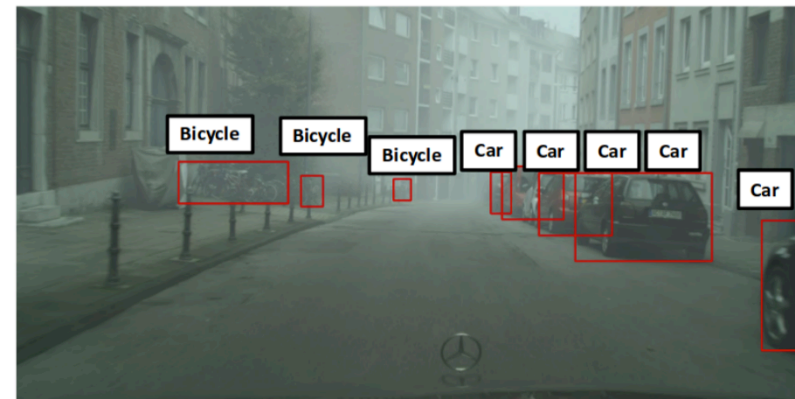Currently under submission at IEEE Computer Vision and Pattern Recognition Conference, 2020

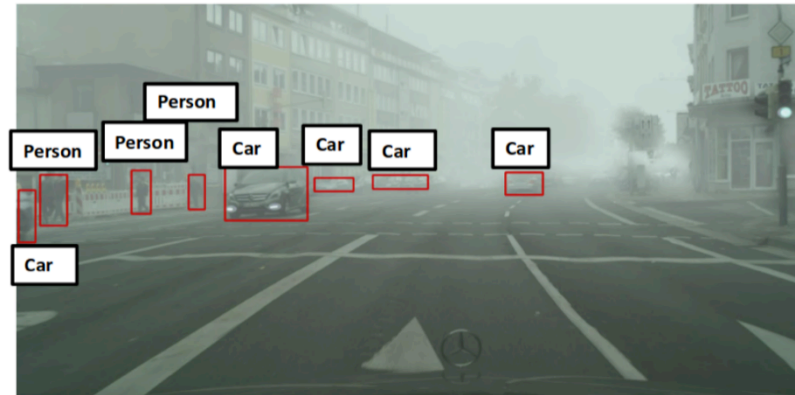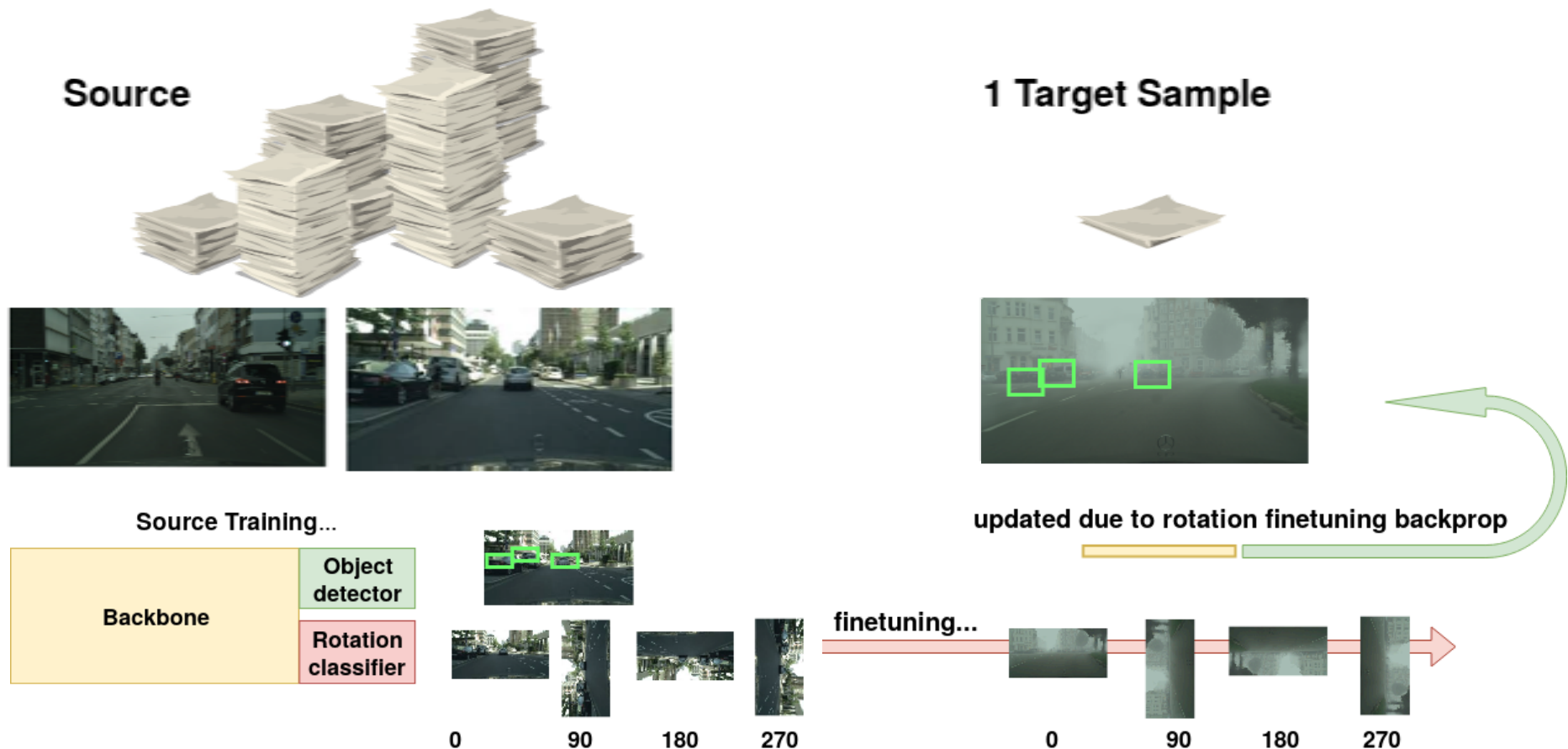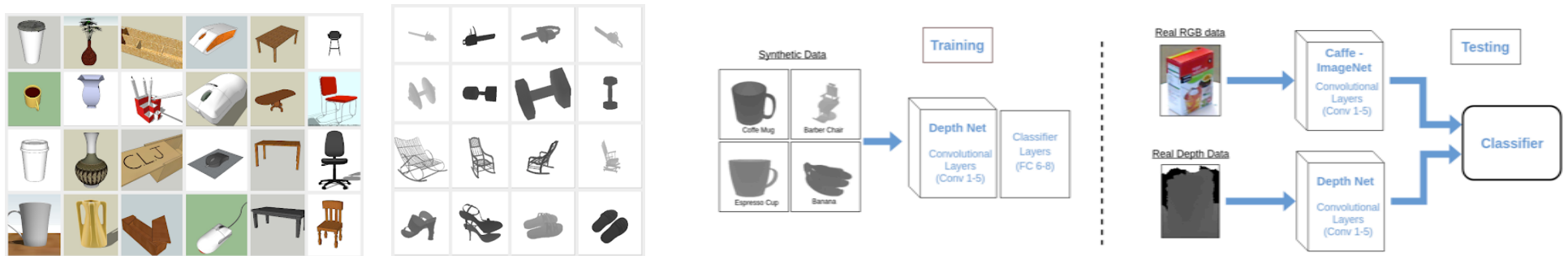# Detection across domains

Detection across domains with a single target sample

Adaptation from synthetic to real - Our Experience

Looking Beyond Appearances: Synthetic Training Data for Deep CNNs in Re-identification,
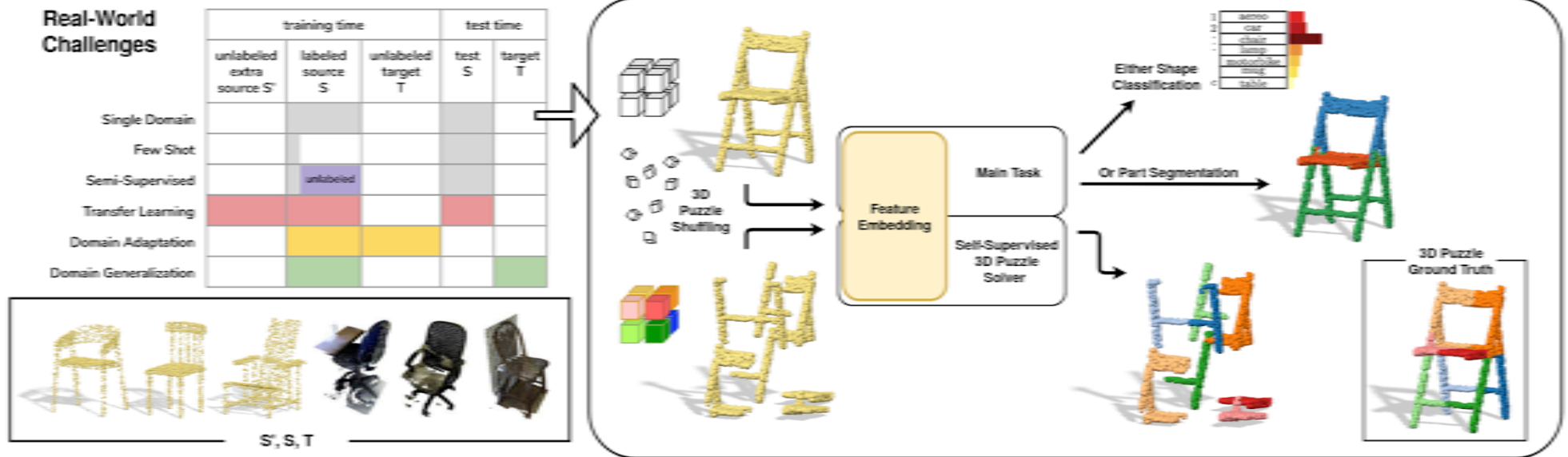I. B. Barbosa, M. Cristani, B. Caputo, A. Rognhaugen, T. Theoharis,

IEEE Computer Vision and Image Understanding, 2018

A deep representation for depth images from synthetic data,
F. M. Carlucci, P. Russo, B. Caputo
IEEE International Conference on Robotics and Automation, 2017

Self-Supervision for 3D object recognition and segmentation

Denoise and Contrast for Category Agnostic Shape Completion.
A. Alliegro, D. Valsesia, G. Fracastoro, E. Magli, T. Tommasi
 IEEE Computer Vision and Pattern Recognition Conference, 2020

Structured Domain Adaptation for 3D Keypoint Estimation
L.O. Vasconcelos, M. Mancini, D. Boscaini, B. Caputo, E. Ricci
International Conference on 3D Vision (3DV), 2019

Self-Supervision for First Person Action Recognition

Particularly challenging:
- Strong Occlusion
- Camera Motion

As for any video-related task there are two important informations:
- the appearance of each frame
- the frame relation: motion

Our idea: add a self-supervised task to learn the motion together with the appearance

AI-H@PoliTO: Artificial Intelligence Hub

Fairness Certification in Artificial Intelligence

tatiana.tommasi@polito.it
barbara.caputo@polito.it
p.asinari@inrim.it

Thanks

tatiana.tommasi@polito.it