SAPIENZA
UNIVERSITÀ DI ROMA

Vision & Perception Projects

DIAG
Dipartimento di Ingegneria Informatica, Automatica e Gestionale "A. Ruberti"

26/04/2023

ALCOR Lab

Rules

- The project can be carried out **individually or in groups** of up to 3 people
- The project is valid for **one academic year**. It is not necessary to submit the project in the same session as the written exam, even if it is highly recommended
- The project is delivered by making a **presentation** of the problem you chose, the proposed solution and the experiments carried out (there will be a specific day for the presentation, one for each session)
- To carry out the project it is necessary to send an **abstract** with the description of the proposed project, the members of the group, and a link to a **Github repository** that will be used for the delivery of the code. We will use **anti-plagiarism** software to make sure the code is really yours.
  This information is sent via a Google Form to be filled in no later than May 16th at 11:59 pm!

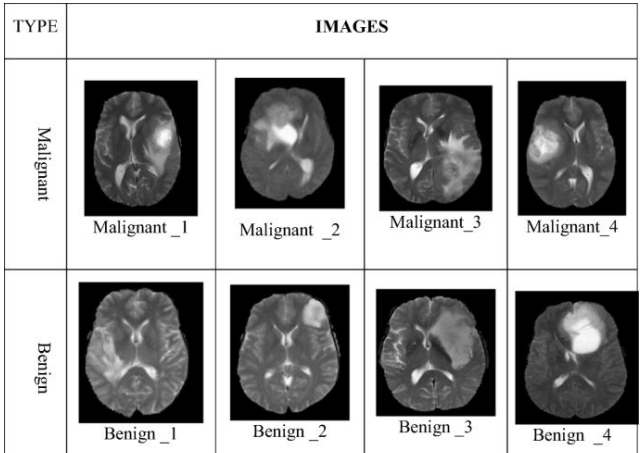
- **Exams on 20 June and 20 July**

Project Topics

- Classification and Detection
- Perception
- Computer Vision on Embedded Devices
- Generative Models
- Multimedia forensics

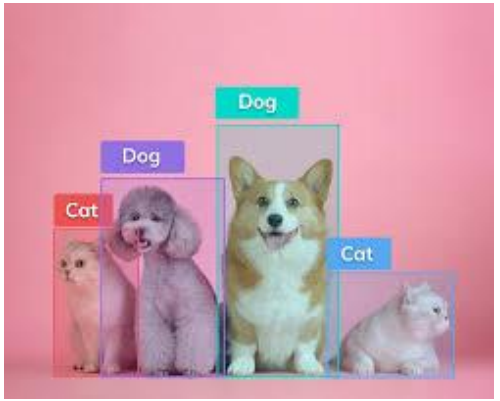
Classification

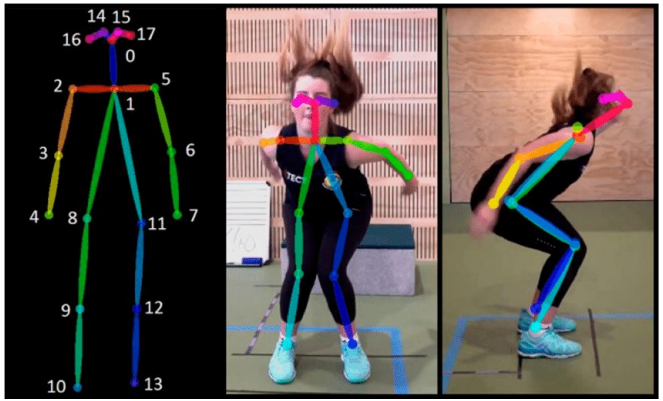
- Medical disease detection (e.g. Tumor, Cancer, ...)
- Activity recognition
- Vehicle Counting and Classification
- Unsupervised classification

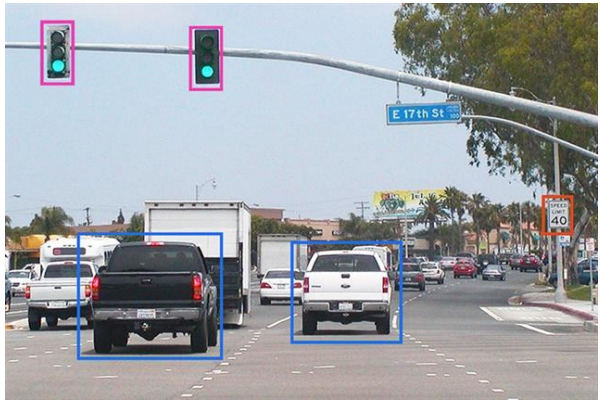


Detection

- Human Pose Detection (e.g. sports)
- Traffic light detection (embedded / real-time)
- Horizon detection in images



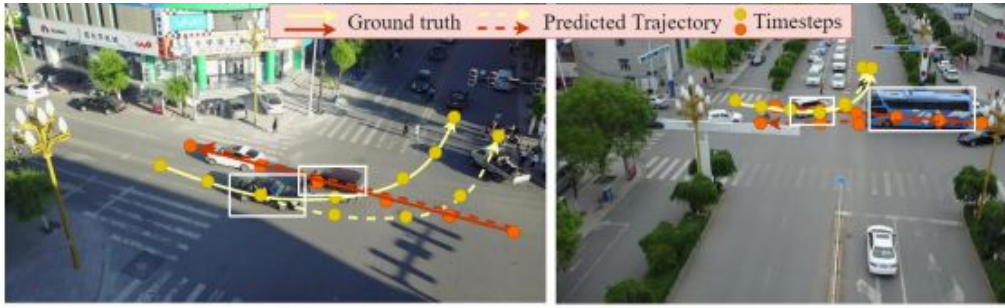




Vehicle behaviour prediction

The project objective is to design a platform that succeeds in reducing hazardous situations during urban mobility.

- Detection of dangerous situations during mobility: road obstacles, potholes, pedestrian
- Recognition of risky driving behavior through vehicle trajectory forecasting



Vodafone Automotive

POLITECNICO MILANO 1863

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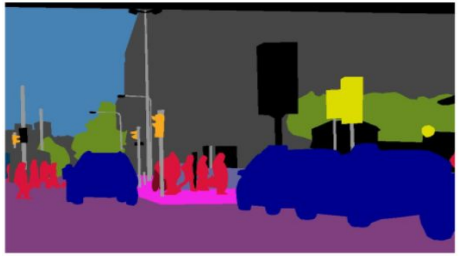
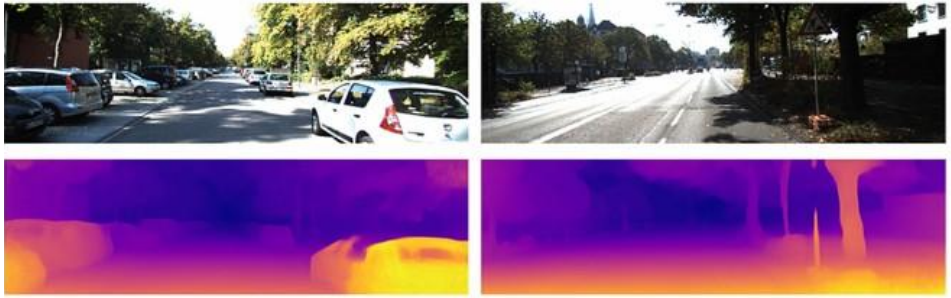
SMART-I insight into

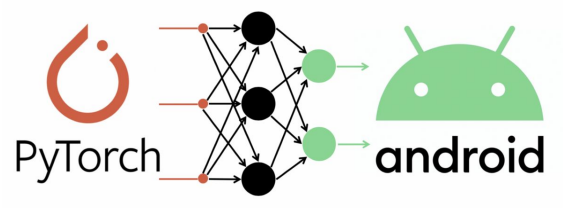
Perception

- Panoptic segmentation
  - Semantic segmentation
  - Instance segmentation
- Image/Depth Reconstruction
- Depth Completion
- Monocular Depth Estimation





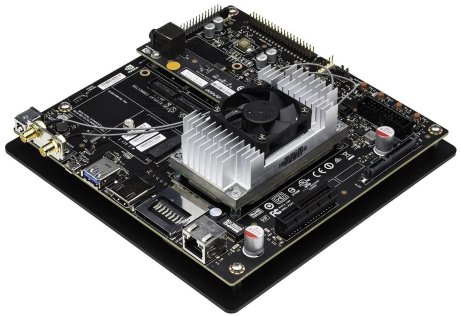
Computer Vision on Embedded Devices



[Pytorch Mobile Link]

[TensorFlow Lite Link]

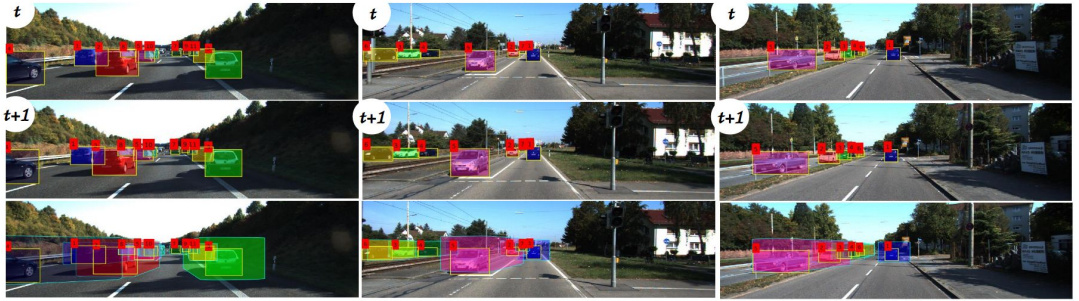
NVIDIA
JETSON

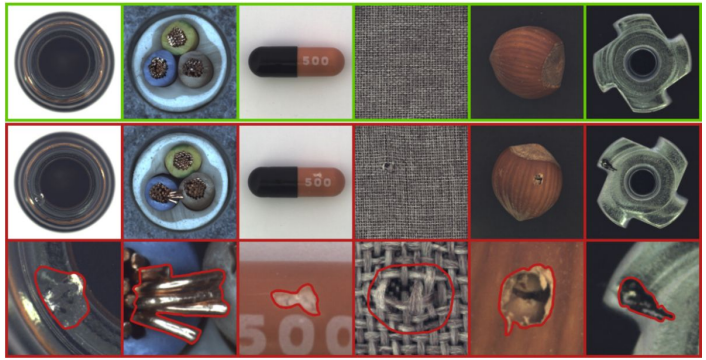


Coral

Embedded & Real-Time

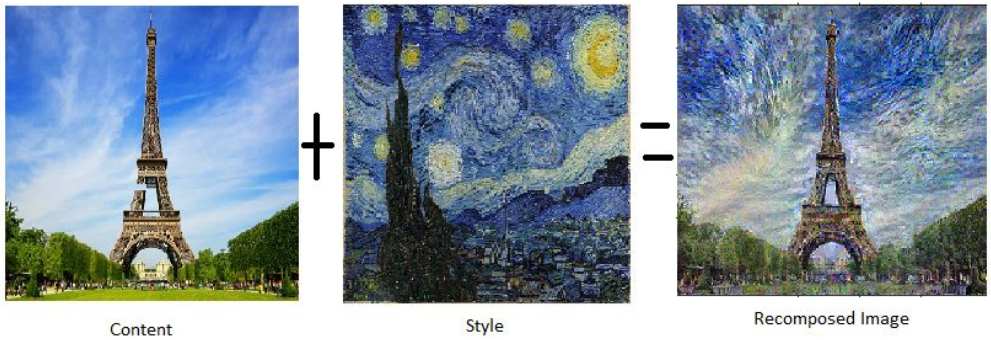
- Collision Avoidance
- Hand Gesture Recognition
- Anomaly Detection
- Parking Occupancy Detection
- Multi Object Tracking





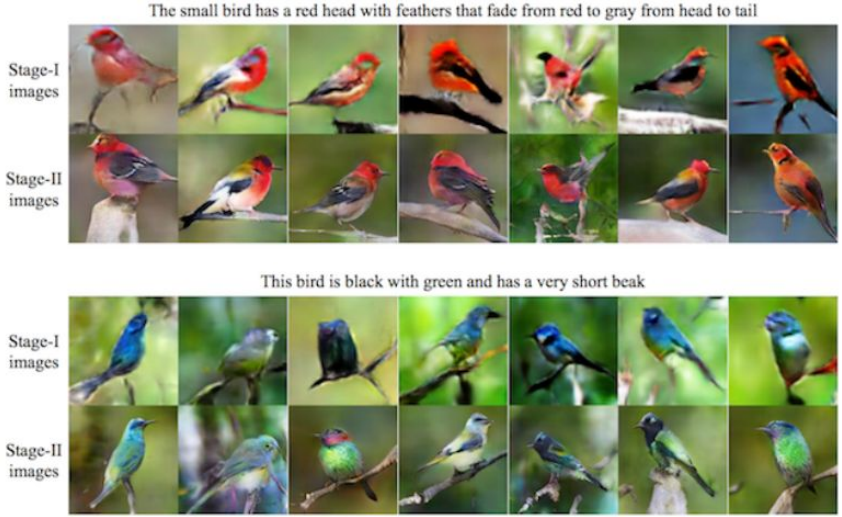
Generative Models

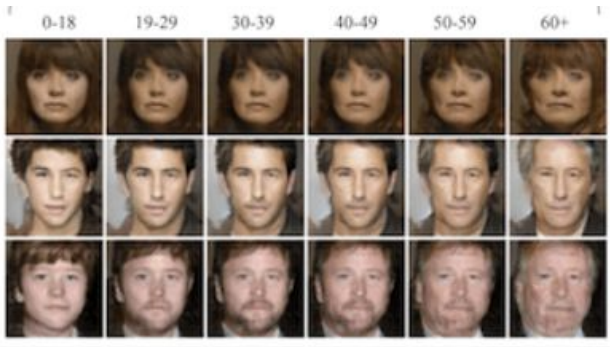
- Automatic Colorization of Photos using Deep Neural Networks
- Style Transfer
- Image Deblurring/Denoising using Generative Adversarial Networks
- Image Super-Resolution



Generative Models

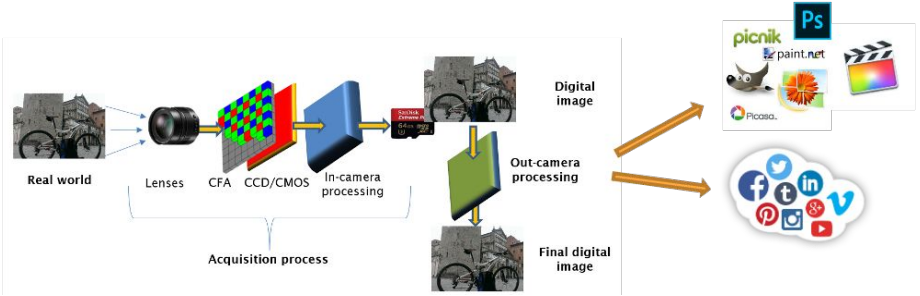
- Realistic images generation
- Text to image generation
- Face aging

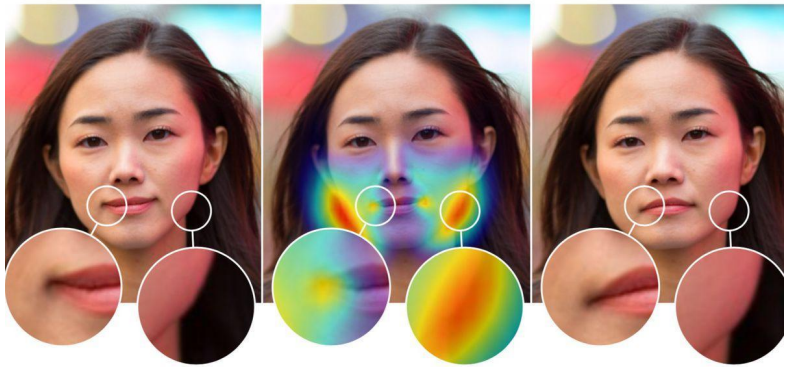




Multimedia forensics

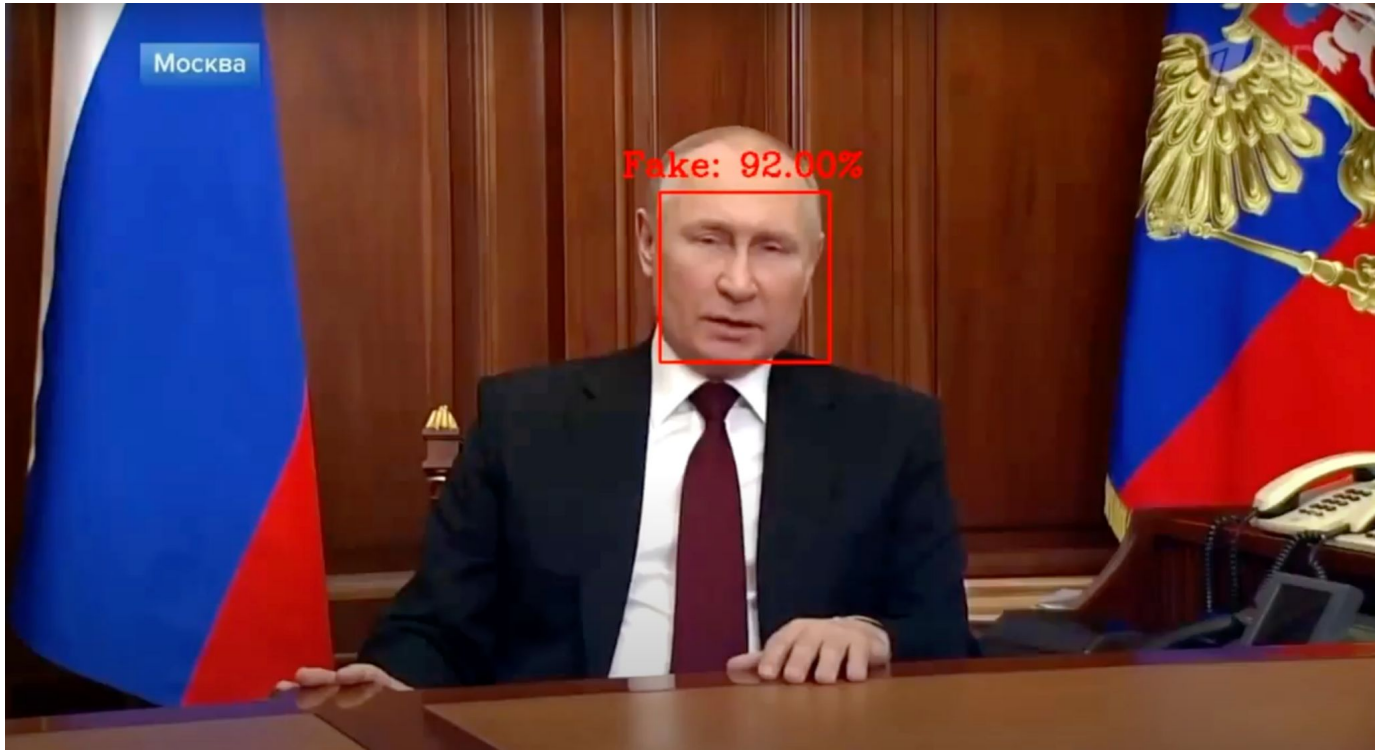
- Forgery detection in images
- Deepfake detection
- GAN, Diffusion model fingerprinting
- Image source reconstruction
- Robustness to adversarial attacks





(a) Manipulated photo (b) Detected manipulations (d) Original photo

A deepfake detection example

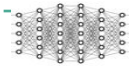


Artificial Intelligence Sandboxing

Adversarial deep learning learning, security and robustness of deep learning algorithms for computer vision sensible task (i.e. military scenario) to build trustworthy machine learning.

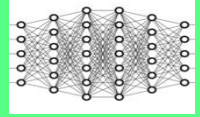
UNCHECKED MODEL

Machine/Deep Learning Model (pretrained)



ADVERSARIAL EXAMPLE

Sandbox



Robustness/ Security score

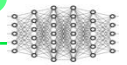
R

REPORT

adversarial example ad-hoc

CHECKED MODEL

Machine Learning/Deep Learning Model



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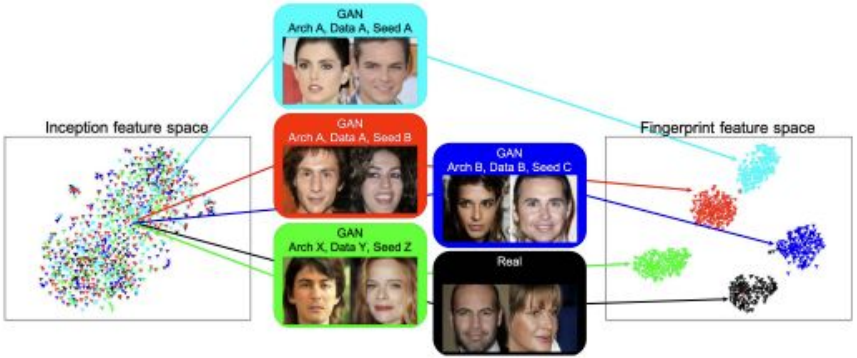
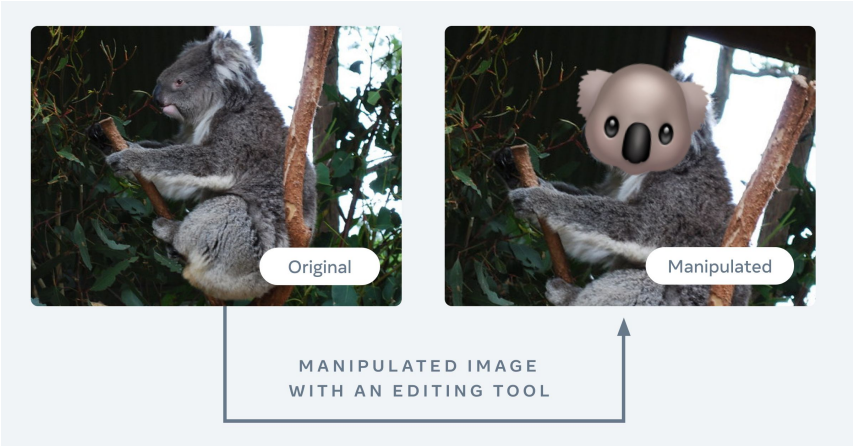
Multimedia forensics: open challenges

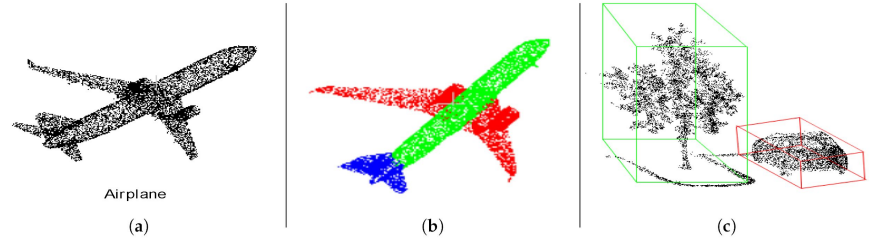
- Hateful meme detection
- Detecting manipulated images: image similarity
- GAN fingerprinting

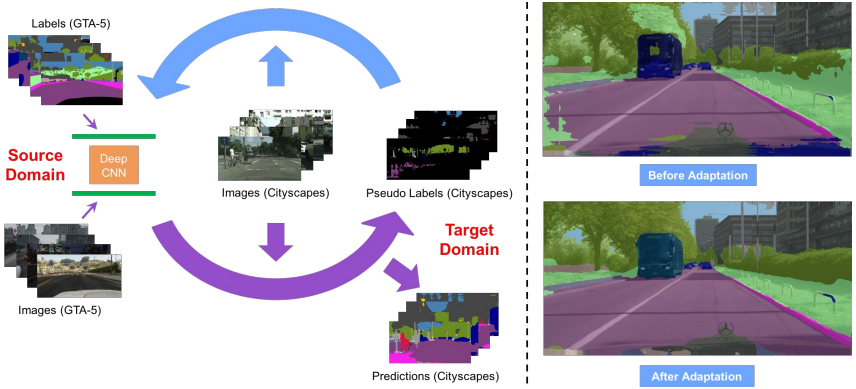


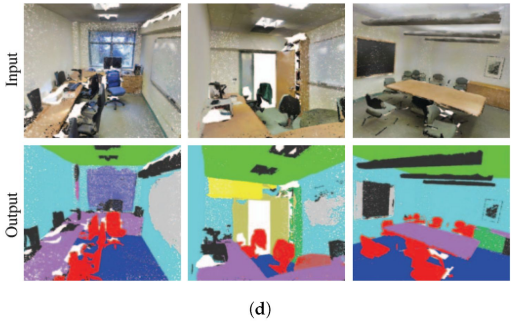


Other topics

- Domain adaptation and/or Generalization
- 3D model reconstruction







Contacts

For questions you can send us an e-mail. Please include **everyone** in the email and specify "[Visiope]" in the email subject.

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