MINES PARIS | PSL

Human-Robot Collaboration in Industry 5.0

MAREVA option research project

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Industrial Context and Challenges

- combine advantages of robots (high speed and repeatability), with those of human workers (flexibility and adaptability)
- support humans in physically challenging tasks and allow automation in scenarios previously considered unfeasible
- complex manufacturing processes possible despite shortage of skilled labor
- contribute to social and economic sustainability of European industry

=> European Commission started a complementary approach to Industry 4.0, called Industry 5.0.

Major Obstacles

the following paradigms are required :

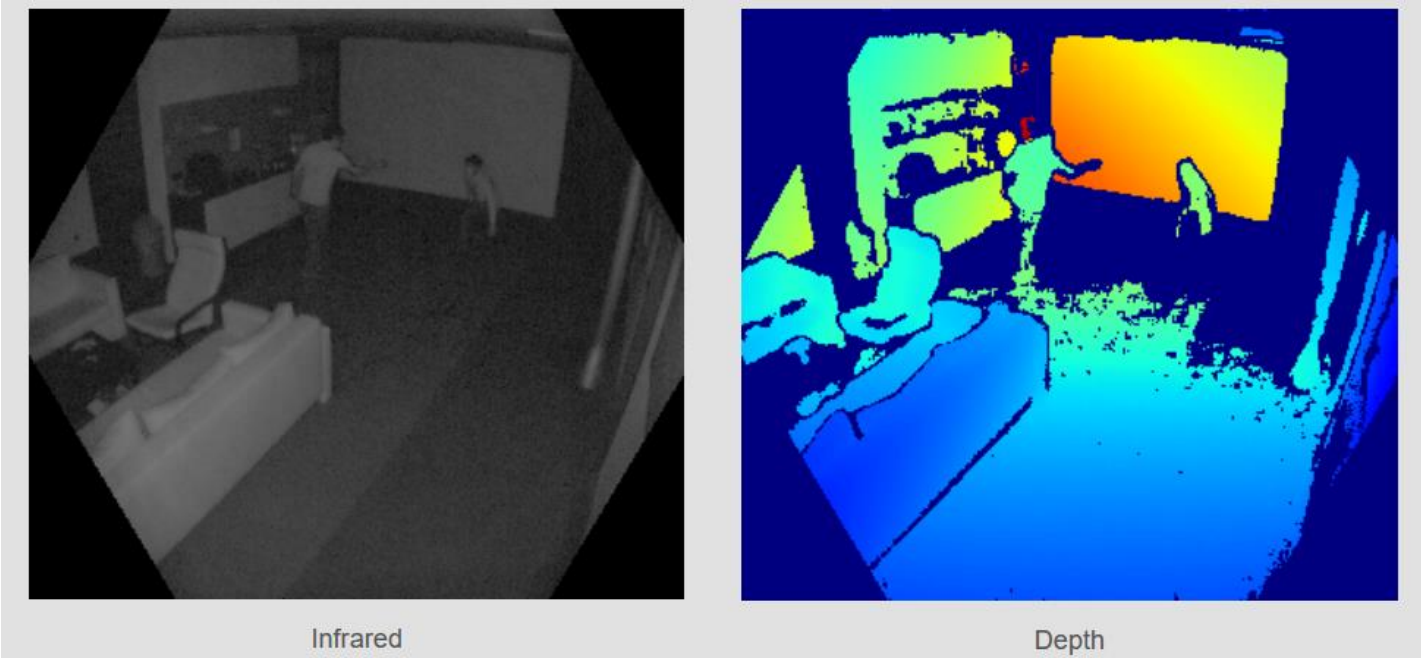
- **safety** – collision avoidance (with humans and obstacles)
- **coexistence** – the robot capability of sharing the workspace with other workers
- **collaboration** – capability of performing robot tasks with direct human interaction and coordination

But are difficult to achieve => the human-robot collaboration has still not been adopted by the industry

Objectives of the project (2/2)

Use machine vision to make robots aware of humans

1. 3D space perception can be provided to the robot using low-cost sensors such as RGB+D (e.g. the Kinect). Convenient datasets with humans are available https://vizta-tof.kl.dfki.de/timo-dataset-overview/ - **top view** : ceiling mount, tilted mount, and **car cabin** datasets. (*)



Example, top, tilted-view , IR+depth image for person detection

(*) Other datasets are mentioned here https://doi.org/10.3390/s22113992

Objectives of the project (1/2)

Use machine vision to make robots aware of humans

2. **Find a model** (or **train a model**) to detect presence of humans and determine the position of all human body parts visible in the image.

3. **Develop a demonstrator using a Kinect device** contenant : 1) acquisition d'un flux video de la Kinect, 2) detection et segmentation des personnes, 3) affichage des silhouettes sur l'écran.

Mini-project assignment

Detailed assignment available here :

Mareva mini-project 2022-2023.pdf