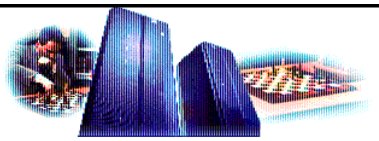

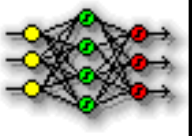

Progetti di Sistemi Intelligenti

Università degli Studi di Milano
Laboratorio di Sistemi Intelligenti Applicati (AIS-Lab)
Dipartimento di Informatica
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Progetti completati

- Fuzzy controllers and FSM for NPC (Non-playable characters) in video-games
- Confronto di regressori (lasso e linear) per un problema di discriminazione: impatto degli iper-parametri.
- Capsule network: analisi, implementazione e valutazione
- Esplorazione iniziale di Algoritmi PPO per reinforcement learning: analisi, implementazione e valutazione.
- Profilazione di utenti (e.g. studenti) attraverso algoritmi di clustering
- Applicazione di algoritmi genetici al problema dello zaino: preparazione di un numero massimo di panini in un'osteria virtuale.
- Implementazione di un avatar che giochi autonomamente giochi archive: (e.g. snake, pong, space invaders), utilizzando fuzzy system, RL,…
- Avatar emotivi: generazione di un repertorio di comportamenti (voce, colore, gesti) associati a diversi stati emotivi.
- Il filo di Arianna: avatar che deve trovare l'uscita di un labirinto, uccidendo mostri e raccogliendo tesori.
- Generazione automatica di storie utilizzando il modello di Propp.
- On the field insects classification through Deep Neural Networks.
- Generazione di alberi mediante grammatica di Lindenmayer.
- Realizzazione di una macchina di Turing.
- Naive Bayes per rilevazione di messaggi di SPAM
- Utilizzo di SOM per realizzare terreni di stile divero

Computer Vision Applications in Robotics

Autonomous navigation is one of the most important features for deploying robots in real world

Application of deep-learning computer-vision methods to robotic-vision tasks.

- Standard computer vision tasks are designed to perform one-shot decision on images, with high generalization capabilities.
- Robot are designed to work in a fixed environments for a long time, seeing the same objects over and over again.

Example Application: Door Detection using a Mobile Robot

References: https://arxiv.org/abs/2203.03959

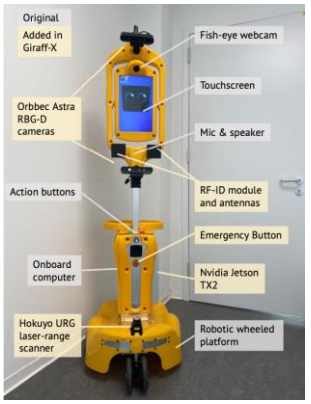
Behaviour Trees for Long-Term Assistive Robotics

Socially Assistive Robots are designed to help fragile users (e.g., elders) in their activities of daily living.

However the functionalities provided by such robots are limited.

In this project, we investigate the challenges towards the long-term autonomy of Socially Assistive Robots, that are required to work without failures in the same environments for a long time.

Our Giraff-X Socially Assistive Robot



References: https://www.sciencedirect.com/science/article/pii/S0921889022000963

Embodied-AI using Simulations

Photorealistic Simulation Tools as NVIDIA Isaac, HabitatAI and iGibson, are a new powerful tools for autonomous mobile robot to learn new complex behaviours and capabilities.

However, it is still complex to transfer capabilities developed in simulation to real world environments.

In this project you will investigate strengths and limitation state-of-the-art of photorealistic simulation tools, with a particular interest to sim-to-real transfer learning.

https://svl.stanford.edu/igibson/
https://ai.facebook.com/blog/near-perfect-point-goal-navigation-from-25-billion-frames-of-experience/

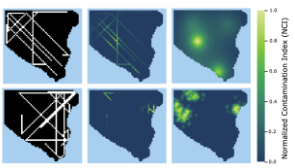
Informative Planning for Autonomous Environmental Monitoring

Background

- Autonomous mobile robots are valuable tools for environmental monitoring applications

Example applications:

- Autonomous Surface Vehicles (ASVs) for water quality monitoring
- Ground rovers for plant disease detection in agriculture



Focus of this project/thesis:

- Develop informative path planning algorithms that allow robots to:
  - collect and process environmental measurements
  - generate concentration maps using active sensing and machine learning
  - optimize future sensing locations through autonomous decision-making

Pattugliamento agricolo

Perlustrazione di campi per early detection dell'esplosione degli infestanti di colture.

Pianificazione intelligente della perlustrazione in funzione di informazioni a-priori raccolte (storia passata, umidita', segnali precoci…)

In collaborazione con il dipartimento di agraria

Vrider

Machine learning for handwriting analysis

Background

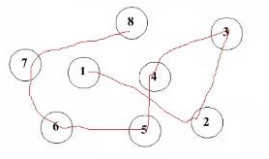
- Handwriting can be used to detect early cognitive decline in older adults

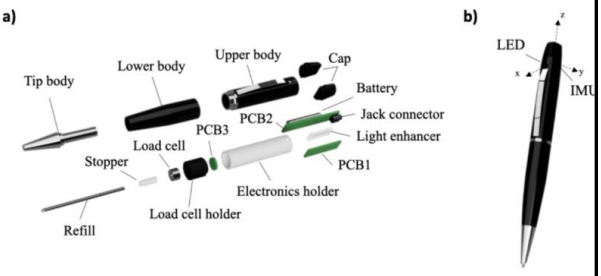
Topic of this project

- Analysis of handwriting from data of a smart sensorized pen and from digital test to detect early cognitive decline
- Analysis of signatures from handwriting to detect motion patterns

Methods

- Variational autoencoders for anomaly detections in time series using smart pen data

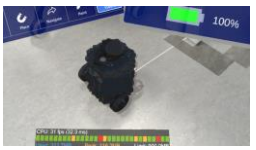




Human-robot inteaction in augmented reality

We integrated has been integrated in a system of augmented reality:
Such system can do this

- See the robot's current state and map withing the real environment
- Interact with it by means of gestures
- Augmented perception with the robot sensors



- **Goal of the project:** development of collaborative or competitive human-robot games based on this framework

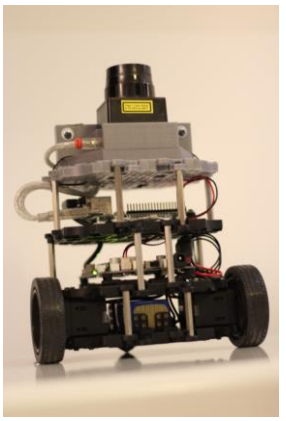
Multirobot exploration

Development of a web-application for controlling with a dashboard a team of robots exploring an unknown environment.

Data perceived by the robots (localization on the map and camera stream) should be accessible from the dashborad

The user should be able to supervise the team of robots and send high-level directives for the team of robots
Skills: ROS, python, C++, mobile robotics

Real robots in the lab



http:\\borghese.di.unimi.it\

Emotional Nao

- Sviluppo di un robot empatico mediante diversi progetti.
  - Use case: **teacher for dancing**: integration of covert emotion transmision: gestures, colors, voice.
  - Use case: giochi da tavolo classici giocati con NAO. **Realizzazione di pedine smart** (Stampante 3D + sensori) che possano essere mosse da NAO in modo autonomo. Sviluppo di un'intelligenza di gioco.

Augmented reality::freezing

Study of freezing in Parkinson patients

Navigation in narrow spaces

Treatment of phobias

- Improve collective behavior of students.
- Improve behavior of the avatar of the self
- Smart dialogues