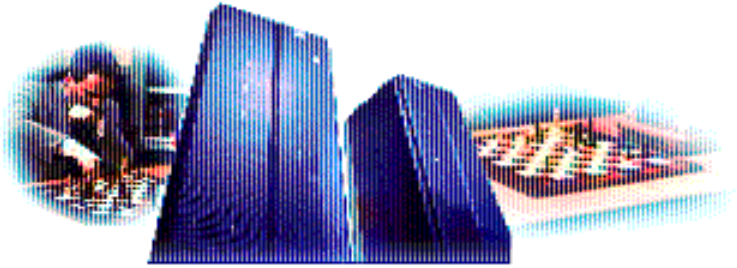

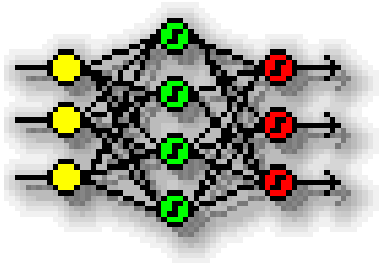

Progetti di Sistemi Intelligenti

Università degli Studi di Milano
Laboratorio di Sistemi Intelligenti Applicati (AIS-Lab)
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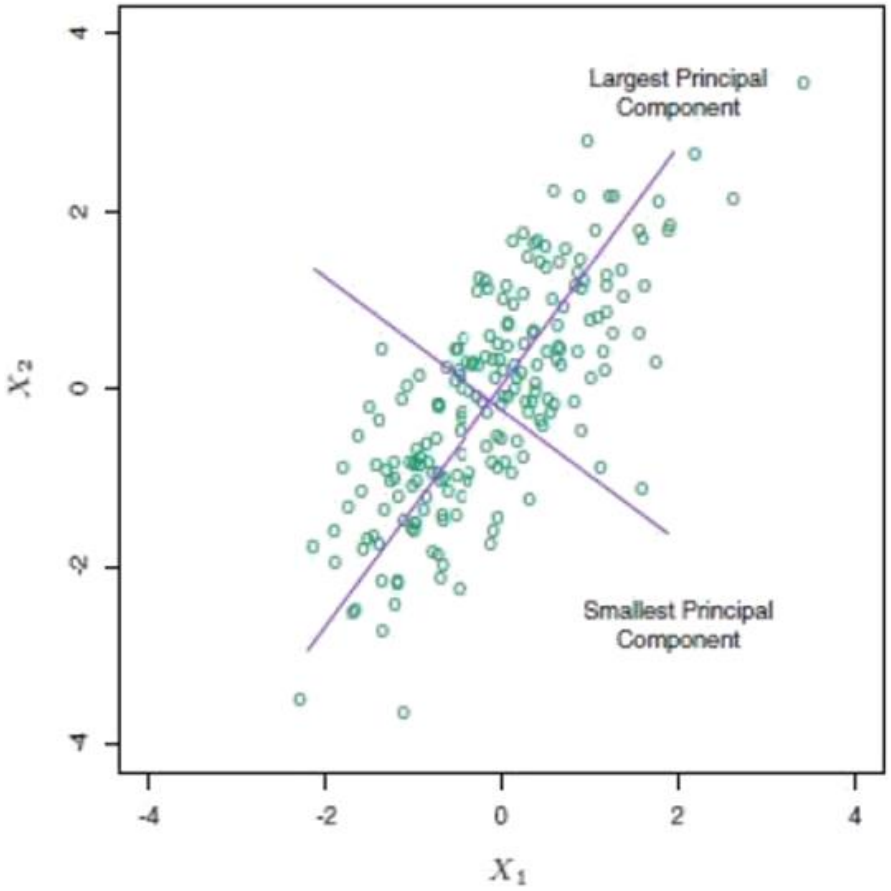
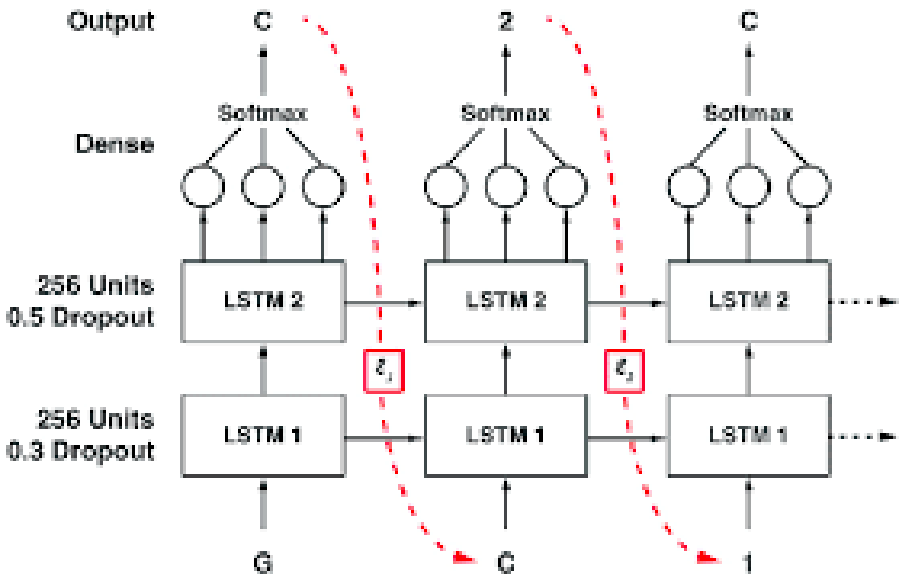
Gait model through smart watch - I



Exploration of variational models like PCA and ICA

Identification of a gait model.
Identification of near-falls.
Identification of peculiarities of each gait.

Gait model through smart watch - II



Exploration of Recurrent Neural Networks through LSTM models

Identification of a gait model.
Identification of near-falls.

ADLs detection through smart watch

The correct identification of Activities of Daily Living (ADL) is a fundamental task to implement an effective remote monitoring of frail or pre-frail users, as elders.

Smart watches can offer both accurate sensing capabilities and computational capabilities to collect real-time ADL-related data.

We ask you to evaluate state-of-the-art algorithms for ADLs identification and falls detection by using smartwatch inertial and biometric sensors by also exploiting publicly available datasets and APIs.

Handwriting analysis

We have realized a smart pen endowed with pressure sensor, accelerometers and gyroscopes that streams wireless the data. We aim to:

A) Recostruction of handwriting trace through a smart pen and stroke segmentation.

B) Graphology through a smart pen to automatically define the user profile.

Topic identification through sentiment analysis

Realization of a system based on a (simplified ontology, e.g. moto-bike and main characteristics) to identify the most hot sub-topic and refine the search.

Analysis of the hottest topics by clustering and correlation analysis.

Speech to text with sentiment analysis

Acquisition of audio and speech statements, translation into text and classification of positive and negative statements:

Realization of a system in which the audio and speech are converted to written text. The system will then identify and classify positive and negative statements.

Quiz game with speech to text

Development of a quiz game in which the system will acquire player's answers to questions expressed through speech.

Once acquired the answer, the system will recognize correct/wrong answers providing positive/ negative feedback (sounds / images) to the player and showing the percentage of correct answers provided.

Auto-calibration of drones

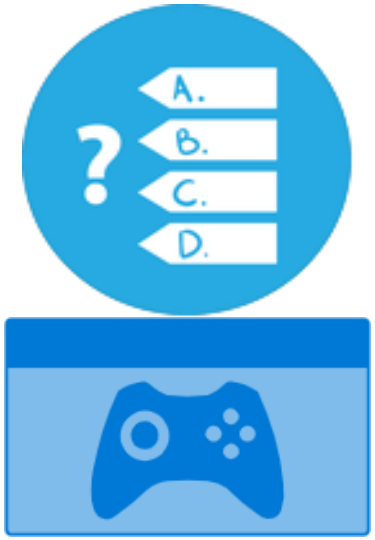
La navigazione accurate dei droni richiede la loro localizzazione precisa nello spazio 3D.

Si vuole esplora l'integrazione delle informazioni multi-dimensionali: GPS, accelerometri e video-camera per localizzarsi nello spazio in modo accurate, derivando anche misure di affidabilità statistica puntuali sulle varie misure (**data fusion**).

Quiz game with empathic feedbacks

Development of a system with a simple quiz game and face's basic emotions classification through camera. The system will provide appropriated positive/ negative feedback through sounds and images on screen based on the correctness of the answer provided and on the player's emotions.

The realization of the system will comprise a set of rules and a finite state machine to drive the interaction.



Empathic Virtual Character

Emotional interaction is becoming a discriminant between intelligent and non-intelligent machines. This is particularly true for service robots and interaction in general.

Realization of an empathic avatar endowed with:

- A stochastic finite state machine that drives the interaction
- A personality as a set of attitude in reaction of emotional stimuli.
- Multi-media output (change of speech pitch / face expression / color)
- Capability of portraying internal emotion (state) through facial animation realized with a simplified FACS
- Capability of adapting the behaviour (FSM) according to a given metric or desired behaviour or target of the interaction.

Design and development of a 3D-printed brush robots and contro

- designing a “bristlebot” or “brushbot” and 3d-print it
- Alternatively propose a new chassis design to exploit **passive locomotion for movements**

and one or more of the following:

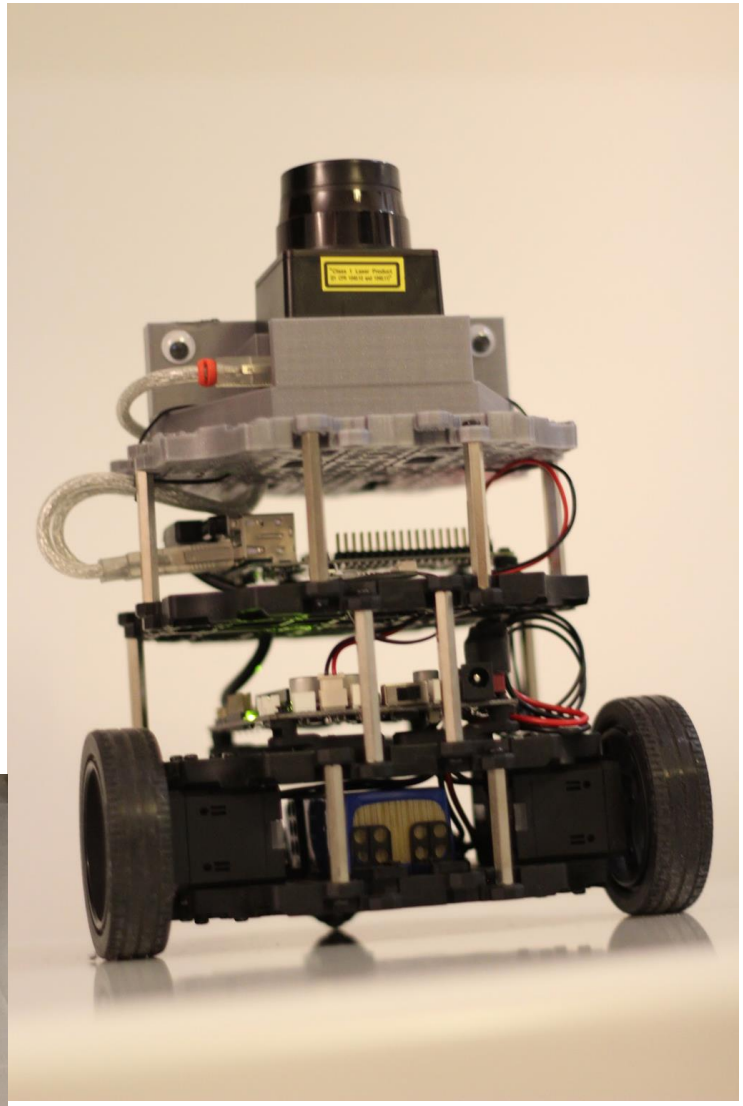
- write a simple control system for the robot
- A/R based robot localization using 2d markers with Vuforia (and or Microsoft Hololens). Localization may be used to make robot automatically reach a target using a fuzzy control system or RL with the Unity ML-Agents package.

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
(localiziont on the map and camera stream)
should be accessible from the dashborad

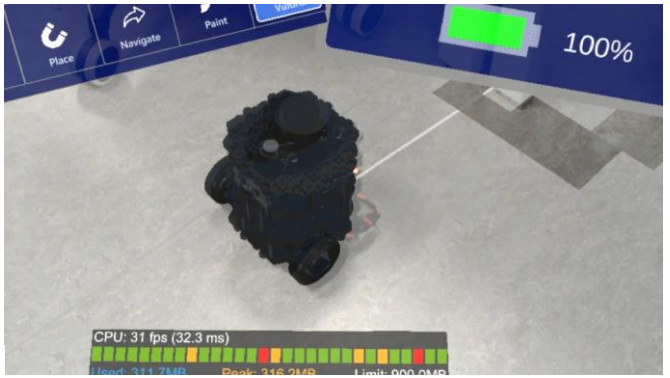
The user should be able to supervise the team of robots and send high-level directives
Skills: ROS, python, C++, mobile robotics

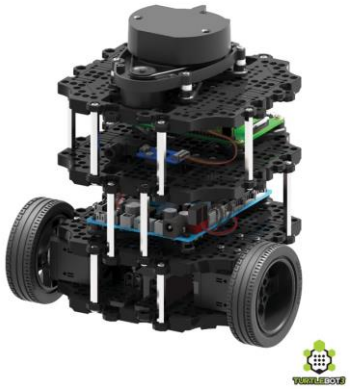


Human-robot inteaction in augmented reality

Turtlebot has been integrated in a system of augmented reality:

- 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
- development of collaborative or competitive human-robot games that might also involve an intelligent avatar.





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Autonomous Navigation

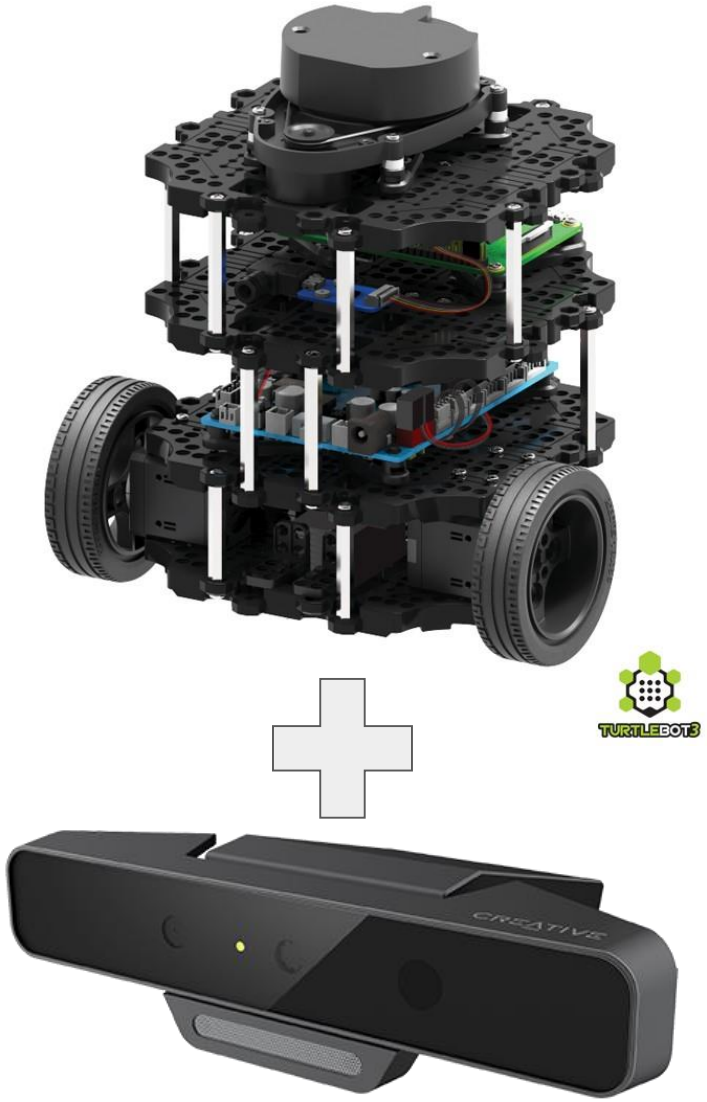
Integration using ROS of a small Turtlebot 3 laser-based autonomous mobile robot with a:

- PI-cam
- Intel Real-sense RGBD camera or Orbecc Astra PRO RGBD camera

In order to enhance its obstacle avoidance and path planning abilities.

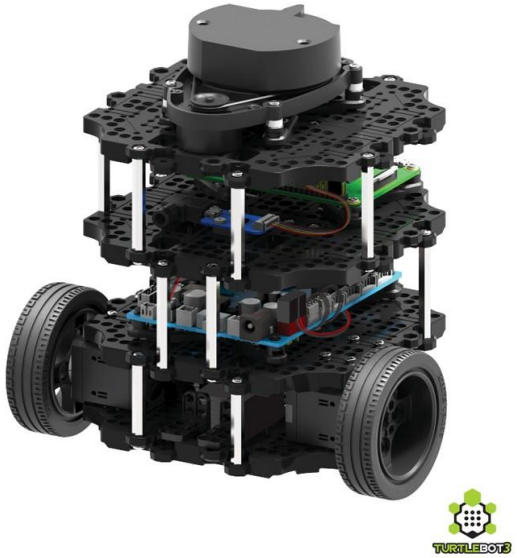
Camera can be onboard on the robot or mounted in the environment.

Integration of pre-trained DNN for object recognition and semantic mapping into the Turtlebot3 framework.



Autonomous Navigation avoiding Hazardous Conditions

One of our Turtlebot3 robot is now integrated with a temperature sensors that is used to detect hazardous condition (e.g. to perform an Urban Search and Rescue mission during a fire).



The project consists in use this external information to develop intelligent behaviour for the robot which can move around environments in thee safest way possible but also with maximising its objectives (e.g. covering the highest area possible in the fastest way possible).

We ask you to integrate information about the room temperature within the robot reasoning mechanism to improve its safety and reliability in rescue missions.

Finding lost objects

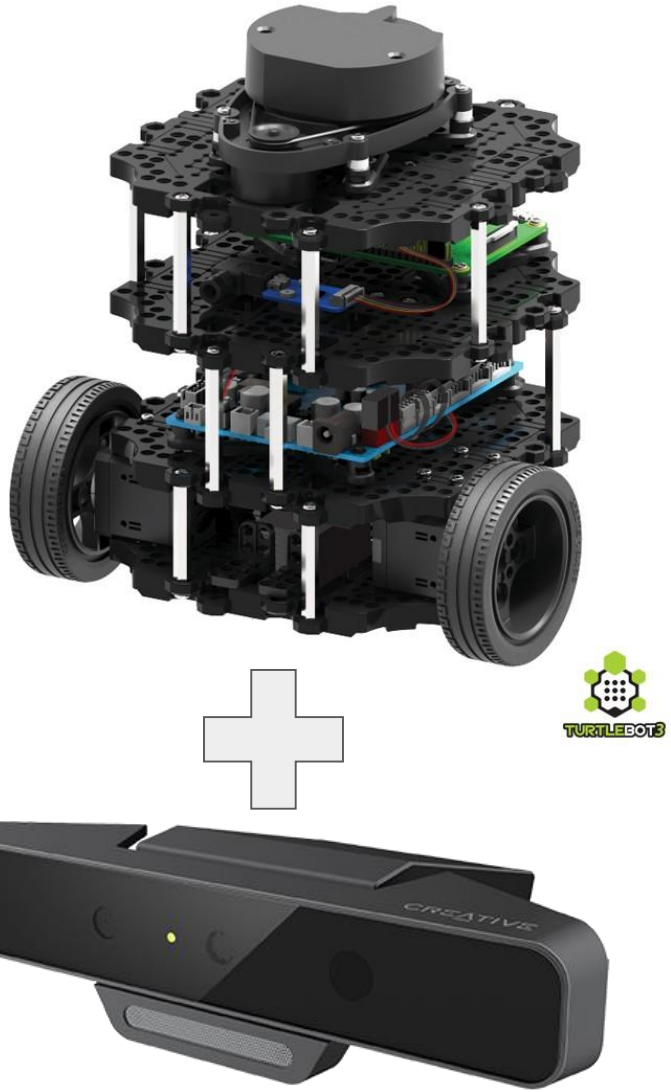
Upgrade of a Turtlebot 3 laser-based autonomous mobile robot with a:

- RGBD camera
- Nvidia Jeston GPU

Integration of DNN-based real time object detection mechanism for finding lost objects (e.g. a telephone, remote controller) inside a house serching in the environment.

Computation is performed on a separate machine (Nvidia Jetson) under a distributed framework

Keywords:
ROS, autonomous robot, deep learning.

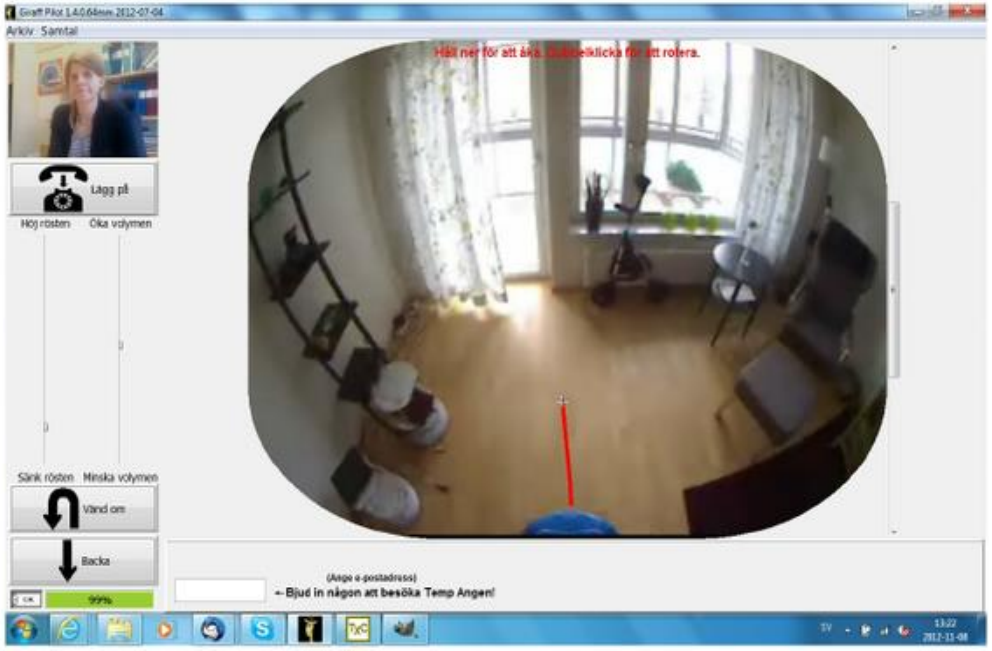


Intelligent Robot Teleoperation

Developing a method to remotely teleoperate a mobile robot in hazardous or emergency condition while also providing a degree of autonomy and intelligent behaviour to the robot: while the user remotely teleoperates the robot, the robot is not limited to blindly executing its commands but optimizes them, interprets them and prevents itself to be stuck in hazardous or dangerous situations (e.g. hitting an object, hitting users). As an example, a command that gives full speed in front of a door produces the robot to correctly pass through that door and not to crash against it.

To perform this we exploit publicly available ROS libraries and machine learning techniques.

Keywords: ROS + python; machine learning, autonomous mobile robotics;



Help a fallen user using an assistive mobile robot

On top of an existing project, develop a deep integration of an autonomous mobile robot with an Alexa or Google-now tool towards the creation of an intelligent robot companion for house apartments (e.g. elderly care) to provide emphatic assistance to elders in need.
Keywords: ROS, Alexa, emphatic text to speech

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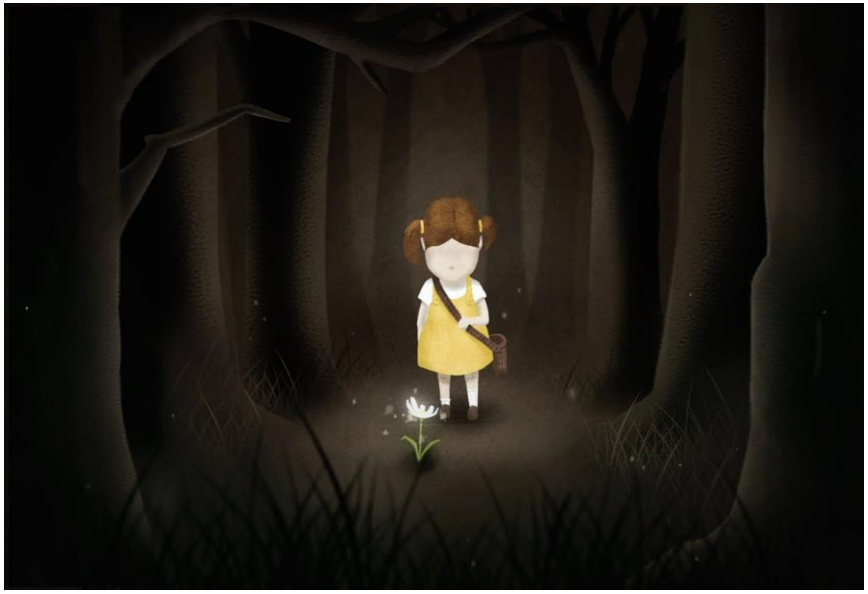
Automatic story narration in Unity

Starting from the output of an in-lab developed story generator, procedurally generate text, art and animations that map story sequences into simple animated scenes used to narrate story events to the final user.



Further developing the paper: Cantoni et al, Procedural constrained story generation based on Propp's and Fabula models, Proc. Segah2020.

https://ieeexplore.ieee.org/abstract/document/9201843