

Computer Vision for Legged Robots

Keywords

Computer Vision, SLAM, Structure from Motion, Visual Servoing, Obstacle Avoidance, Legged Robots.

1 Description

The Dynamic Legged Systems Lab (DLS) is currently working on the implementation of computer vision algorithms for a range of diverse applications for quadruped robots (stair climbing, terrain mapping, obstacle avoidance, visual servoing, automatic sensor calibration, among others). Our hydraulic quadruped robot series - HyQ - is a fully torque-controlled system, capable of locomotion over rough terrain and performing highly dynamic tasks such as jumping and running with a variety of gaits. It is a unique research platform, designed for unstructured environments.

Autonomous legged robots are required to handle a wide range of tasks in complex environments. Current computer vision algorithms are not robust in dynamic environments, however, using computer vision is critical to improving autonomy. It is well-known that video images provide rich information about the environment which is critical for localization in environments without a priori maps. For example, such uncertainty in environment would be expected in monitoring a disaster scene.

We are currently looking for a highly motivated, full-time internship position to work on the implementation, evaluation and further development of computer vision algorithms [1, 2, 3] into our legged robot framework.

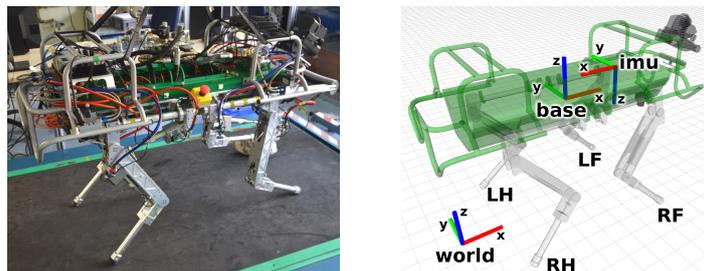


Figure 1: IIT's Hydraulic Quadruped Robot (HyQ).

2 Tasks

- Implement the already developed algorithms in order to increase computation efficiency, code readability and reusability

- Explore ways to improve autonomy using visual servoing, obstacle avoidance, and SLAM
- Explore ways to improve state estimation using computer vision algorithms and sensor fusion
- Experimental verification

3 Requirements

At the moment of application, the candidate must have earned at least a bachelor degree in computer science, systems and control, robotics, mechanical engineering or electrical engineering, or related.

Further requirements include:

- Strong programming skills in C++ and Python
- Knowledge of a computer vision including multiple view geometry
- Strong communication skills (written and spoken) in the English language
- Strong team player
- Willingness to integrate into a multidisciplinary, dynamic, international research group
- Knowledge about robot kinematics and dynamics, visual servoing, SLAM, and control theory is a plus
- Hands-on experience in robotic systems is a big plus
- Programming skills in OpenCV, CUDA, and Matlab/Simulink is a plus

4 Duration

Minimum 6 months, with the possibility of extension depending on achieved results.

5 How to apply

To apply send an e-mail including your detailed CV, university transcripts and cover letter outlining motivation, experience and qualifications for the position to geoff.fink@iit.it stating “[Intern19] Computer Vision Position” in the subject of the e-mail.

References

- [1] M. A. Bloesch, *State estimation for legged robots—kinematics, inertial sensing, and computer vision*. PhD thesis, 2017.
- [2] S. Huang and G. Dissanayake, “Special issue on localization and mapping in challenging environments,” *Robotics and Autonomous Systems*, vol. 97, pp. 16 – 17, 2017.
- [3] F. Chaumette and S. Hutchinson, “Visual servo control. ii. advanced approaches [tutorial],” *IEEE Robotics Automation Magazine*, vol. 14, pp. 109–118, March 2007.