Nao-Team HTWK Leipzig

Open Challenge Description: Sparse Feature Learning for Visual Robot Angle Estimation

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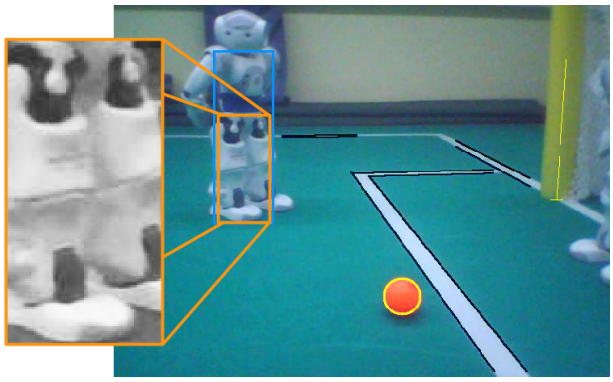
One of our research efforts of the past year has been robot detection based on visual information. Until now we were able to determine the position and team (waistband) of a robot without the need for prior color calibration. This data is fed into a global model containing the positions of our own and the opposing robots.

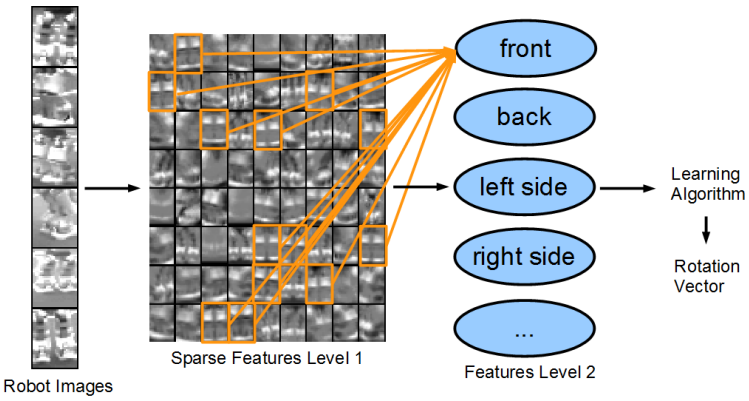
In the Open Challenge 2013 we will present an extension of our visual robot detection framework to determine the rotation of detected robots. This allows us to determine information about whether an opposing robot is facing towards us or away from us. This information can be used to optimize behaviours withing the team strategy, e.g. determining whether to dribble by the left or right side of an opponent which is in our way, or even in which direction a frontal kick of a robot in a penalty shoot situation might go.

The algorithm is based on unsupervised learning which determines sparse features of robot feet/legs in unlabeled training data. (See fig. 1) These featuers are later used by a deep neural network to determine a two-dimensional relative vector which describes the rotation of the detected robot. Training this neural network is done using only a few labeled training images.

In the execution stage on our robot this angle estimation is applied to all robot regions detected in the camera image. As ususal in our vision framework, this methodology does not need on-site calibration. It has an average error of 0.14 rad, and, being basically just some matrix multiplications, consumes approx. 0.23 ms of runtime per robot region.



(a) detected robot rect



(b) angle estimation network