

Publication Overview

2004 – 2020

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`https://github.com/jkerdels/pub_overview`

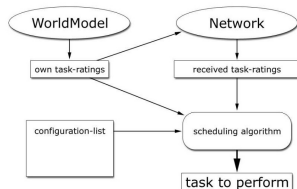
July 22, 2020

Decentral Control in Robot Teams

We developed a **decentral scheduling algorithm** that allows multiple robots to coordinate their behavior to achieve a common goal in a challenging, dynamic environment where communication might be intermittent and the number of robots might change without prior notice [1, 2].

Characteristics of our approach:

- synchronization free
- low-bandwidth broadcast communication
- graceful degradation in case of
 - communication outages
 - loss of team members
- continuous replanning



Schematic of the proposed scheduler (from [1]).

The scheduling algorithm was successfully used during the RoboCup 2004 competition winning the Standard Platform League Open Challenge [3]. [video](#)

[1] J. Ziegler et al. *Virtual Robot - Adaptive Ressource Management in Robot Teams*. Technical Report 0204. presented at International RoboCup Worldchampion, Lissboa, July 2004. University of Dortmund, 2004 [PDF](#) [bibtex](#)

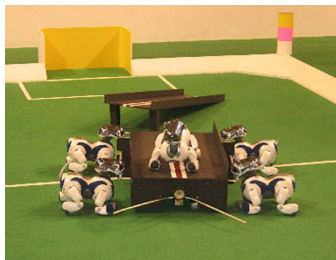
[2] I. Dahm et al. "Decentral control of a robot-swarm". In: *Autonomous Decentralized Systems, 2005. ISADS 2005. Proceedings. Apr. 2005*, pp. 347–351. DOI: 10.1109/ISADS.2005.1452083 [PDF](#) [bibtex](#)

RoboCup 2004

As an undergraduate I participated in a yearlong **robotics project** in which we programmed ERS-210 and ERS-7 robotic dogs made by Sony to compete in the Standard Platform League (SPL) of the international **RoboCup 2004 competition**.

Our technical report [3] provides an in-depth look into the core challenges of teaching robots to play soccer, the solutions developed by our team, and the involved support infrastructure.

As part of the GermanTeam – a collaboration between the universities of Berlin, Bremen, Darmstadt, and Dortmund – we won the world championship in the SPL as well as the SPL Open Challenge.



Scene from the SPL Open Challenge (from [3]).

[3] Ingo Dahm et al. *Virtual Robot: Automatic Analysis of Situations and Management of Resources in a Team of Soccer Robots*. Tech. rep. PG 442 Final Report. University of Dortmund, 2004 [PDF](#) [bibtex](#)

Diploma Thesis

My diploma thesis [4] presents a novel approach to **discover objects in unlabeled image data** using a combination of traditional methods including image segmentation, feature extraction, clustering, and dynamic programming.

The key idea consists of using **image segmentation to group features** in an image, and use these feature groups to represent the individual segments in a way that is invariant to rotation, scale, and translation.

Such feature segments can then be related to each other by an appropriate distance measure to **identify segments that occur repeatedly** in different contexts.

Finally, neighborhood relations among segments can be learned in a similar fashion to **discover stable feature segment constellations** that indicate the presence of reoccurring structures, i.e., putative objects in the images.

[4] Jochen Kerdels. "Dynamisches Lernen von Nachbarschaften zwischen Merkmalsgruppen zum Zwecke der Objekterkennung". [Diplomarbeit](#). Diplom. University of Dortmund, Aug. 31, 2006 [PDF](#) [bibtex](#)

References I

- [1] J. Ziegler et al. *Virtual Robot - Adaptive Ressource Management in Robot Teams*. Technical Report 0204. presented at International RoboCup Worldchampion, Lissboa, July 2004. University of Dortmund, 2004.
- [2] I. Dahm et al. "Decentral control of a robot-swarm". In: *Autonomous Decentralized Systems, 2005. ISADS 2005. Proceedings*. Apr. 2005, pp. 347–351. DOI: 10.1109/ISADS.2005.1452083.
- [3] Ingo Dahm et al. *Virtual Robot: Automatic Analysis of Situations and Management of Resources in a Team of Soccer Robots*. Tech. rep. PG 442 Final Report. University of Dortmund, 2004.
- [4] Jochen Kerdels. "Dynamisches Lernen von Nachbarschaften zwischen Merkmalsgruppen zum Zwecke der Objekterkennung". Diplomarbeit. Diplom. University of Dortmund, Aug. 31, 2006.