



## Team Description Paper 2023

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### 1 Team Information

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### 2 Code Usage

Most of the rUNSWift codebase has been incrementally developed over the years. We would like to thank the Nao Devils team for the use of their camera driver first used in 2018, with some modifications.

The basic structure of the 2022 vision system remains the same as that of 2017-19 [2], [3], [1].

Localisation and state estimation remain largely the same as 2018 [3] and 2019 [1].

rUNSWift’s motion is primarily based off the Hengst’s walk generator [4] developed in house and used since the 2014 RoboCup competition.

The basic structure of the 2022 tooling remains the same as that of 2019 [1].

### 3 Own Contribution

While rUNSWift had made significant contributions previously, during the period from 2019 to present, the ongoing research hasn’t resulted in publishable articles yet.

We are working on several major improvements that should result in significant contributions to the state-of-the-art in 2024-2025. Currently, we have a number of experimental tools with which we plan to investigate and improve our weakest aspects of play.

#### 3.1 Vision

Historically, the team has been using a multi-stage vision pipeline with a mixture of ML-based and algorithm-based approaches. We are developing an experimental approach that would allow us to train the vision pipeline using a single ML model instead. This significant undertaking requires us to build tools for capturing auto-labeled data during the game and under special situations on the field. In 2022-2023 period, we have been working on a set of tools to enable the data capture and auto-labeling for future training.

#### 3.2 Motion

A simulator based on PyBullet[6] is under development to be used as a platform for testing and improving robot motions. The main use for this is to test different getups and walks in simulation so as to not cause wear/damage to real robots. We also hope to use Deep Reinforcement Learning to further tune our fall and getup motions using this simulator.

#### 3.3 Architecture

The team has been working on implementing and testing ROS2 nodes running on the robot. We see great potential in supporting an ecosystem of well-maintained, narrow-purpose, open-source packages based on ROS as it would allow for easier innovation translation between RoboCup SPL and the industry at large.

## 4 Past History

Team *rUNSWift* has been competing in the Standard Platform League (SPL) since 1999. Every year, we strive to improve the weakest aspects of our system and adapt it to new challenges presented by the SPL technical committee (TC) through rule changes.



**Fig. 1.** The rUNSWift 2022 team members at RoboCup 2022 in Bangkok, Thailand. *From left to right:* Peter Schmidt, Abhishek Vijayan, Maria Lizura, Claude Sammut, Mikhail Asavkin, Neeraj Gopikrishnan

In 2022, RoboCup returned to the in-person format of Sydney 2019 and prior years, at the Bangkok International Trade and Exhibition Center (BITEC) Thailand. The competition took place from 13-16 July 2022, with a day and a half of setup and a closing research symposium. The seeding round consisted of a Swiss tournament which seemed to accommodate the 13 competing teams better than the pools and play in rounds of prior years. A single-elimination tournament decided the winner, with a 3rd place playoff added. rUNSWift achieved 3rd place in the competitions at BITEC, equaling the team's performance in Sydney 2019.

rUNSWift feels fortunate to have placed 3rd overall this year, winning 2 games out of 4 in the seeding round, a quarter final and 3rd place game.<sup>1</sup>

For the upcoming year, we plan to focus on rebuilding the team's capability post-COVID, passing the metaphorical baton to a new generation of RoboCuppers. We might also take part in GORE2023 by sending robots if remote participation is possible.

## 5 Impact

### 5.1 On SPL

The Hengst walk engine [4] won 2014 and 2015 and reached the final of 2016 as part of the UT Austin Villa system. Further it was integrated into B-Human

<sup>1</sup> <https://spl.robocup.org/results-2022/>

**Table 1.** Results of competitive games from 2019-2022

Competition	Level	Opponent	Score	Result
RoboCup 2022	Third-place	Nao Devils	<b>1-0</b>	win
RoboCup 2022	Semi-finals	B-Human	<b>6-0</b>	loss
RoboCup 2022	Quarter-finals	UT Austin Villa	<b>1-3</b>	win
RoboCup 2022	Round 4	SPQR Team	<b>0-5</b>	win
RoboCup 2022	Round 3	UPennalizers	<b>5-0</b>	win
RoboCup 2022	Round 2	UT Austin Villa	<b>0-0</b>	draw
RoboCup 2022	Round 1	HTWK Robots	<b>3-0</b>	loss
GORE 2022	Quarter-finals	RoboEireann	<b>0-1</b>	loss
GORE 2022	Round 6	SPQR Team	<b>0-0</b>	draw
GORE 2022	Round 5	R-ZWEI KICKERS	<b>5-0</b>	win
GORE 2022	Round 3	B-Human	<b>0-7</b>	loss
GORE 2022	Round 2	Bembelbots	<b>1-0</b>	win
GORE 2022	Round 1	HULKs	<b>6-0</b>	win
RoboCup 2019	Third-place	Nao Devils	<b>11-2</b>	win
RoboCup 2019	Semi-finals	B-Human	<b>3-0</b>	loss
RoboCup 2019	Quarter-finals	TJArk	<b>5-0</b>	win
RoboCup 2019	2nd Round Robin	Bembelbots	<b>7-0</b>	win
RoboCup 2019	2nd Round Robin	HULKs	<b>5-0</b>	win
RoboCup 2019	1st Round Robin	Camellia Dragons	<b>4-0</b>	win
RoboCup 2019	1st Round Robin	UT Austin Villa	<b>4-0</b>	win
German Open 2019	Third-place	HULKs	<b>1-2</b>	loss
German Open 2019	Semi-finals	B-Human	<b>5-0</b>	loss
German Open 2019	Play-in	Berlin United	<b>10-0</b>	win
German Open 2019	Round Robin	HTWK	<b>1-4</b>	loss
German Open 2019	Round Robin	HULKs	<b>2-1</b>	win
German Open 2019	Round Robin	NomadZ	<b>8-0</b>	win

2017 code release.<sup>2</sup> . A labelled dataset for field segmentation consisting of 20 videos was published in 2021 [5].

In addition, rUNSWift has had several members become members of the SPL OC and TC in the past, as well as most recently, the current president of RoboCup.

## 5.2 On UNSW & local community

During Open Day at UNSW held on 3 September 2022, rUNSWift set up a robotics demo stall including Naos playing on a small field, to inspire prospective students to consider Computer Science/STEM in general as a career, also entertaining small children to create positive associations with robots.

rUNSWift also organizes demo games on the full SPL standard field in the Kensington lab periodically as a platform for recruitment, refereeing, training, and to inform students about RoboCup and SPL.

With regard to coursework, students are given the option to work on a project related to RoboCup as a part of a Robotics Software Architecture course offered at UNSW, offering them a chance to expand their knowledge by working on a real project.

rUNSWift has historically had an association with Kensington Primary School<sup>3</sup>, for example on 9 August 2018 taking Nao robots on site to inspire questions, inform and entertain K-6 students.

rUNSWift looks forward to a potential future including competition taking place on the recently redeveloped village green synthetic football field built to FIFA accreditation standard.<sup>4</sup>

## 6 Other

### Acknowledgements

The 2022 team wish to acknowledge the legacy left by previous rUNSWift teams and deeply thank the School of Computer Science and Engineering, University of New South Wales for their continued administrative, financial and laboratory support to our team. We'd also like to warmly thank additional sponsors and contributors, including though not limited to, RoboWorks, Marathon Robotics, Ocius, ANT61, WisME and CR8. We also wish to pay tribute to all RoboCup and in particular RoboCup SPL teams that inspire and drive our innovations in the spirit of friendly competition.

<sup>2</sup> See Section 8.3: Walking <https://b-human.de/downloads/publications/2017/coderelease2017.pdf>

<sup>3</sup> <https://kensington-p.schools.nsw.gov.au/>

<sup>4</sup> <https://www.estate.unsw.edu.au/village-green-redevelopment-0>

## References

1. Ashar, J., Brameld, K., Jones, E.R., Kaur, T., Li, L., Lu, W., Pagnucco, M., Sammut, C., Sheh, Q., Schmidt, P., Wells, T., Wondo, A., Yang, K.: runswift team report 2019. Tech. rep., The University of New South Wales (2019)
2. Bai, G., Brady, S., Brameld, K., Chamela, A., Collette, J., Collis-Bird, S., Hall, B., Hendriks, K., Hengst, B., Jones, E., Pagnucco, M., Sammut, C., Schmidt, P., Smith, H., Wiley, T., Wondo, A., Wong, V.: runswift 2017 team report and code release. Tech. rep., The University of New South Wales (2017)
3. Brameld, K., Hamersley, F., Jones, E., Kaur, T., Li, L., Lu, W., Pagnucco, M., Sammut, C., Sheh, Q., Schmidt, P., Wiley, T., Wondo, A., Yang, K.: runswift 2018 team report and code release. Tech. rep., The University of New South Wales (2018)
4. Hengst, B.: rUNSWift Walk2014 report. <https://github.com/UNSWComputing/rUNSWift-2014-release/blob/master/20140930-Bernhard.Hengst-Walk2014Report.pdf>, University of New South Wales (2014)
5. Lu, W.: The rUNSWift SPL Field Segmentation Dataset (08 2021)
6. rUNSWift: PyBullet Simulator, <https://github.com/UNSWComputing/PyBullet-Nao-Motion-Editor>