UT Austin Villa Team Description Paper*

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1 Team Information

UT Austin Villa is a team from The University of Texas at Austin. The team information is summarized below:

- Team Name: UT Austin Villa
- Team Leaders: Peter Stone, Siddharth Desai, Sai Kiran Narayanswami
- Contact Email Addresses: sidrdesai@utexas.com, nskiran@utexas.edu
- Team Website URL: http://www.cs.utexas.edu/~AustinVilla
- Country of Origin: United States of America
- University Affiliation: The University of Texas at Austin

2 Code Usage

Listed here are the uses of other team's code in our competition code. All other modules were written by members of the UT Austin Villa team. Our code base has seen a significant change this year, so the usage declaration is divided into two parts.

2.1 Code Usage 2018-2022

At RoboCup 2018, 2019, 2021, and 2022 we used the walk engine, goalie squat and subsequent get-up from the rUNSWift 2015 code release [7], the get-up from the B-Human 2014 code release [8], and the geometry utilities from the B-Human 2011 code release [9].

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2.2 Anticipated Code Usage 2023

At RoboCup 2023, we will most likey be using the walk engine from the UNSW 2019 code release [6], and the get-up from the B-Human 2014 code release [8].

In addition, we will be using certain ros2 packages developed by Kenji Brameld from the UNSW Robocup team. The packages we will be using are: nao_lola, nao_interfaces, ros2_rcss3d, and naosoccer_sim. [10]

We may also use kinematics code from another team such as rUNSWift or B-Human.

3 Own Contribution

This year, we have rewritten significant portions of our codebase to use ros2. We believe this framework will reduce the barrier to entry for new teams wanting to join the SPL. The new framework has been designed with the goal of being modular and easy to understand, which should help foster greater collaboration for research.

In addition, we've made advancements to our vision system building off of the framework we introduced last year. In the 2022 competition, we deployed a novel deep object detection system for detecting balls, robots and crosses. We became the first to train accurate deep object detectors in an end-to-end manner that are capable of running onboard the Nao v6 at realtime framerates of more than 35Hz. The details of our object detector and its development are described in our RoboCup symposium paper: [1].

Based on the above work, we are developing a general framework for visual perception where the behavior directs the use of different networks as needed to maximize the use of available (limited) computational power. For example, the behavior could choose to run a smaller model for tracking the ball once it has seen it while using the saved effort for better localization. We aim to use this architecture in RoboCup 2023 to significantly enhance the capabilities of our vision system.

We also hope to release our sim-to-real pipeline for tuning the walk engine in simulation if it can be made stable in time for the competition.

4 Past History

Scores from matches we've played since 2019 are shown in Table 1.

No actual matches during the 2021 competition since the competition was held remotely. We ranked fourth overall.

5 Impact

UT Austin Villa has been a part of the SPL league for many years. During this time, our team has ranked among the top eight teams most years. In addition,

Table 1. Robocup Results from 2019 (left) and 2022 (right)

Opponent	Score	Result
rUNSWift	0:4	L
Camellia Dragons	5:0	W
B-Human	0:10	L
SPQR	2:0	W
Dutch Nao Team	7:0	W
HTWK	10:0	L

Opponent	Score	Result
Nao Devils	0:8	L
rUNSWift	0:0	-
Naova	8:0	W
Bembelbots	1:1	-
SABANA Herons	3:1	W
rUNSWift	1:3	L

we've made several research contributions through our robocup efforts. A notable example is our work from last year on low-resource deep object detection [1], which has opened new avenues for the use of deep learning in SPL and has highlighted the potential for the league to contribute to research in Edge AI. We have also published several papers on sim-to-real directly using the Nao Robots [2–5]. This research was inspired by RoboCup, and we have used the results to improve our robot's walk; however these results have applications in other robotics research as well.

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