Internship: Learning Robot Navigation

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At Naver Labs we are working on the next generation of robot navigation approaches. Robot navigation is typically addressed by two types of methods:

- Classic hand-designed algorithms that use deterministic planners on metric maps [MJ2011].
- More recent deep learning methods that use image input and are trained in simulated environments [SAU+2021].

Figure: A Locobot robot at Naver Labs Europe navigating in a real environment, learning to avoid obstacles [SBC+2022].

Both of these approaches have shortcomings, but for different reasons. Classical algorithms are brittle and lack in performance as soon as the situation does not correspond to the simplifying assumptions they were designed for. Besides, they have difficulties dealing with perceptual uncertainties, mapping and localization errors and dynamic obstacles. Learning based algorithms lack in robustness because of the gap between simulations and real physical environments ("sim2real gap"). Furthermore, they are difficult to inspect and interpret.

Recently, hybrid methods [CGG+2020][CGGb+2020][CSG+2020][DSS+2011] have been emerging that aim to combine learned and deterministic planners to achieve robust robot navigation policies. However, it is still unclear what is the best way to combine different navigation approaches. In this internship we want to investigate and evaluate different strategies to implement robust and interpretable hybrid robot navigation methods. The internship will start with a focus on methods developed and evaluated in simulation. If time will allow, the developed solution will be demonstrated on a mobile robotic platform.

The ideal candidate is rigorous and creative, has good coding skills and familiarity with deep learning and robotics. You will join a team of people working on the topic and have access to mobile robot platforms and computation resources to experiment with new ideas.

Skills
- Good knowledge of machine learning and deep learning
- Good coding skills, especially in PyTorch

- Familiarity with ROS and robotics are a plus
- Knowledge of deep reinforcement learning and SLAM are a plus

Duration: 6 months, in 2022.

Place: Naver Labs Europe, Meylan, France

References

[CGG+2020] Devendra Singh Chaplot, Ghandi, Gupta, Gupta, Salakhutdinov. Learning to explore with Active Neural SLAM. ICLR 2020.

[CGGb+2020] Devendra Singh Chaplot, Ghandi, Gupta, Salakhutdinov. Object Goal Navigation using Goal-Oriented Semantic Exploration, NeurIPS 2020.

[CSG+2020] Devendra Singh Chaplot, Ruslan Salakhutdinov, Abhinav Gupta, Saurabh Gupta, Neural Topological SLAM for Visual Navigation. In CVPR 2020.

[DSS+2011] Nitish Dashora, Daniel Shin, Dhruv Shah, Henry Leopold, David Fan, Ali Agha-Mohammadi, Nicholas Rhinehart, Sergey Levine. Hybrid Imitative Planning with Geometric and Predictive Costs in Off-road Environments, Deep RL Workshop at NeurIPS 2021.

[SAU+2021] Habitat 2.0: Training Home Assistants to Rearrange their Habitat, Andrew Szot et al., NeurIPS 2021.

[SBC+2022] Assem Sadek, Guillaume Bono, Boris Chidlovskii and Christian Wolf. An in-depth experimental study of sensor usage and visual reasoning of robots navigating in real environments. In ICRA, 2022.

[MJ2011] Steve Macenski and Ivona Jambrecic. SLAM Toolbox: SLAM for the dynamic world," Journal of Open Source Software, vol. 6, no. 61, 2011.