

Emergency Signal Localization for Autonomous Drones

Short Description

This project aims to implement emergency signal localization using a microphone array for autonomous drones.

Introduction

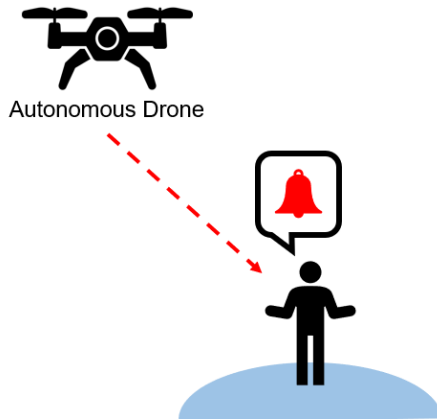


Figure 1 Search and Rescue Scenario

Autonomous drones can take care of various tasks for us in an extreme environment. One of the viable tasks is to search and rescue people in a dangerous situation (e.g., fire and landslide). In general, autonomous drones use computer vision to detect and localize their targets. However, there can be a situation where computer vision is helpless. For example, if a person is in a very dark place, autonomous drones cannot use computer vision to localize the person. In this case, autonomous drones can use audio signals for localization.

Sound source localization is a traditional research topic in signal processing. However, sound source localization is not easy for drones because of the noise from their propellers and motors. Furthermore, the task becomes more challenging when multiple sound sources exist. There exist several research papers that propose how to reduce the ego noise from drones and provide

accurate sound source localization from multiple sound sources¹.

This project aims to implement sound source localization for emergency signals on top of an open-source flight control system, PX4 Autopilot². Recently, IEEE Signal Processing Cup 2019 proposed a challenge of building a sound localization system with a microphone array for a drone³. This project will use the baseline code and dataset for the challenge available online.

Application Scenario

An autonomous drone detects emergency signals (e.g., whistle) from microphones and localizes the sound source of the signals. After localization, the autonomous drone navigates to the sound source for rescue.

Goal & Tasks

- Review existing sound source localization techniques
- Implement a sound source localization system on PX4 Autopilot
- Evaluate the sound source localization system

Prerequisites

- Programming skills in Python or Matlab
- Experience with Robot Operating System (ROS)
- Background knowledge on signal processing

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Character

- Student team project
- Bachelor thesis (BA)
- Master semester project (SA)

¹ T. Yamada, K. Itoyama, K. Nishida and K. Nakadai, "Sound Source Tracking Using Integrated Direction Likelihood for Drones with Microphone Arrays," 2021 IEEE/SICE International Symposium on System Integration (SII), 2021.

² PX4 Autopilot: Open Source Autopilot for Drones, <https://px4.io/>

³ A. Deleforge, D. Di Carlo, M. Strauss, R. Serizel and L. Marcenaro, "Audio-Based Search and Rescue With a Drone: Highlights From the IEEE Signal Processing Cup 2019 Student Competition [SP Competitions]," in IEEE Signal Processing Magazine, vol. 36, no. 5, pp. 138-144, September 2019.