2026/02/12 Prof. Takano

Student: Muhammad Tsaqif Mukhayyar, PENS
Supervisor: Prof. Kosuke Takano

Title of research topic:

**Two-Phase Context Recognition in Dynamic Mobile Observation Systems**

## 1. Problem Definition

Mobile observation systems using vehicles and drones are widely applied to environmental monitoring, agriculture, traffic analysis, and indoor navigation. However, captured scenes continuously change depending on time, location, and environmental conditions. Although deep neural networks achieve high recognition accuracy, they rely on predefined training data and struggle with ambiguous, unseen, or context-dependent targets. A single recognition model is therefore insufficient for dynamic mobile observation environments. This study addresses the challenge of designing a context-aware recognition architecture that adapts to environmental changes and handles unknown or ambiguous targets.

## 2. Originality

This research proposes a two-phase context recognition architecture:

Phase 1: Global Context Recognition performs coarse scene understanding and identifies environmental context (e.g., urban, farmland, indoor).

Phase 2: Adaptive Detailed Recognition conducts fine-grained detection or anomaly recognition guided by the contextual information from Phase 1.

The originality lies in explicitly separating global context understanding from detailed object recognition and using contextual priors to dynamically adapt recognition strategies in mobile systems.

## 3. Expected Benefits

- Improved robustness under environmental shifts
- Better handling of ambiguous or unknown targets
- More efficient computation through context-guided model selection
- Applicability to environmental monitoring, smart agriculture, intelligent transport, and disaster response

The proposed framework contributes to adaptive and scalable perception systems for real-world mobile observation platforms.