



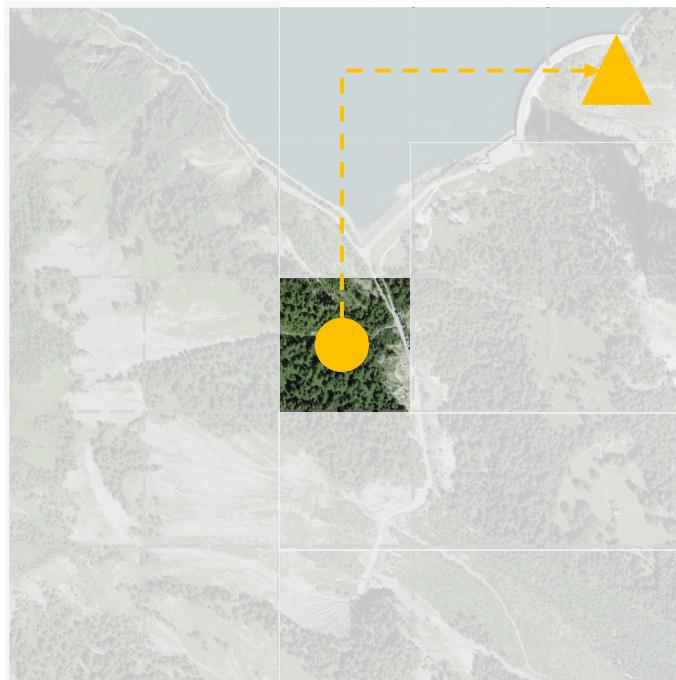
# GeoExplorer: Active Geo-localization with Curiosity-Driven Exploration

Li Mi, Manon Béchaz, Zeming Chen, Antoine Bosselut, Devis Tuia

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# 1. Introduction

## Active Geo-localization



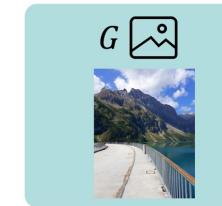
▲ goal



● start



I



G

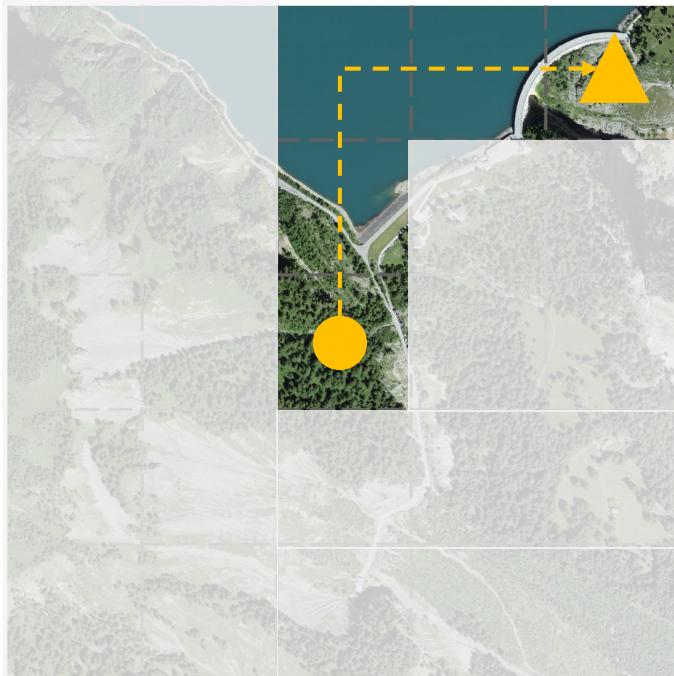
T

I walk along the curved path beside the calm, blue water of a dam. Tall mountains stand in front of me.

[UP, DOWN, LEFT, RIGHT]

# 1. Introduction

## Active Geo-localization



### Goal-reaching reinforcement learning

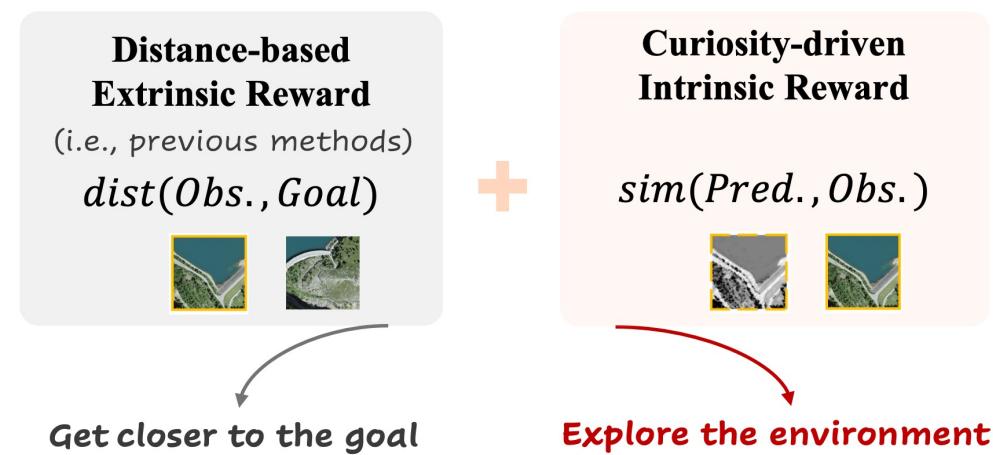
- Environment
- Agent
- Actions

# 1. Introduction

## GeoExplorer

Improve the representation generalizability by:

- Environment modeling
- Environment exploration

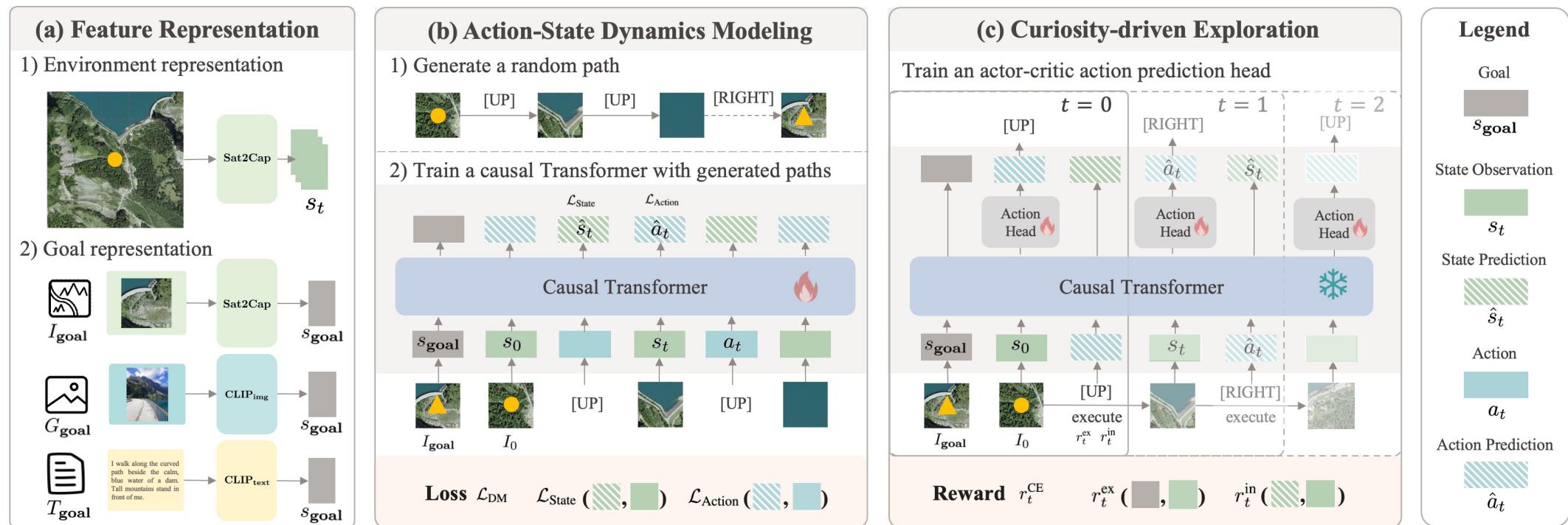


GeoExplorer combines **goal-oriented reward** and **curiosity-driven reward**

# 2. Method

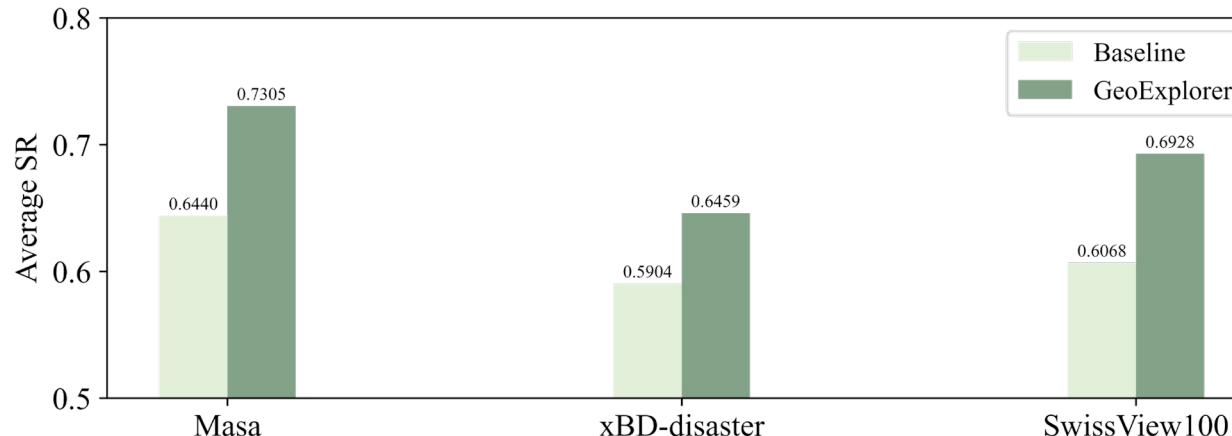
## Pipeline

- Feature representation
- Model the environment
- Explore the environment

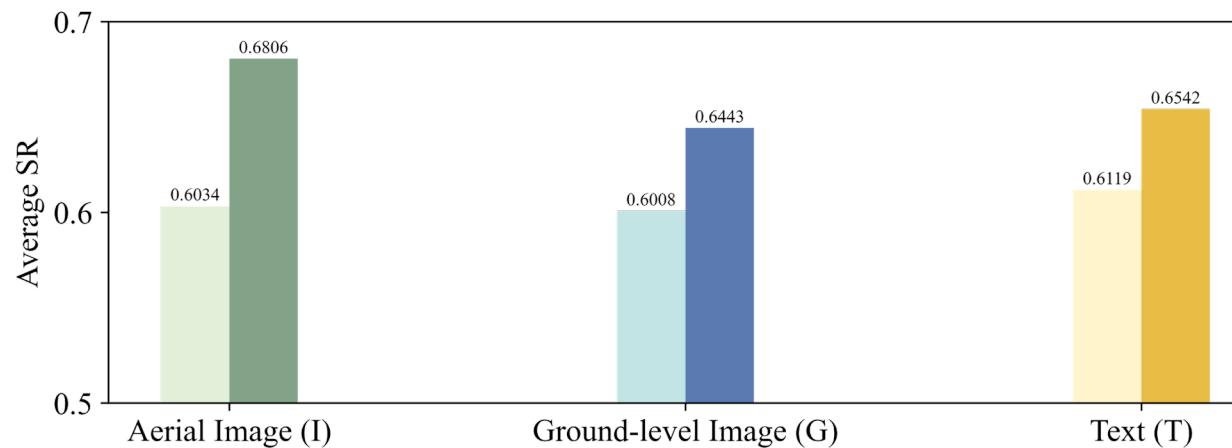


# 3. Results

- Validation and Cross-domain Generalization



- Multimodal Generalization

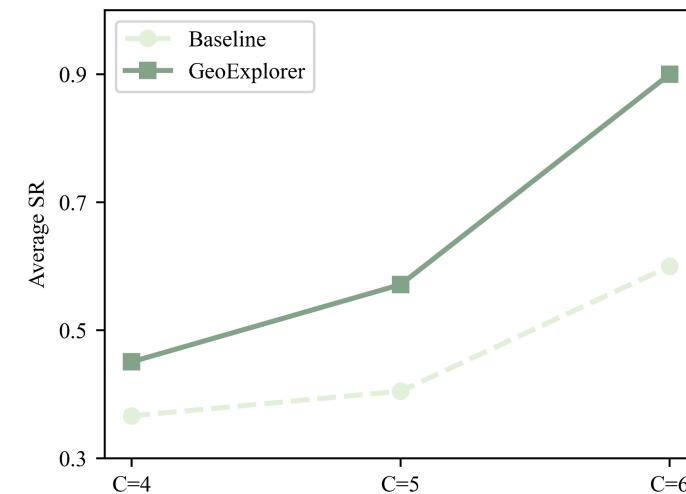
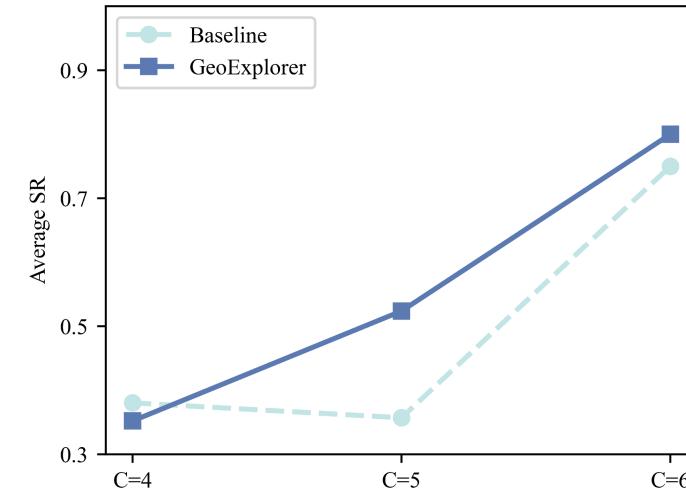
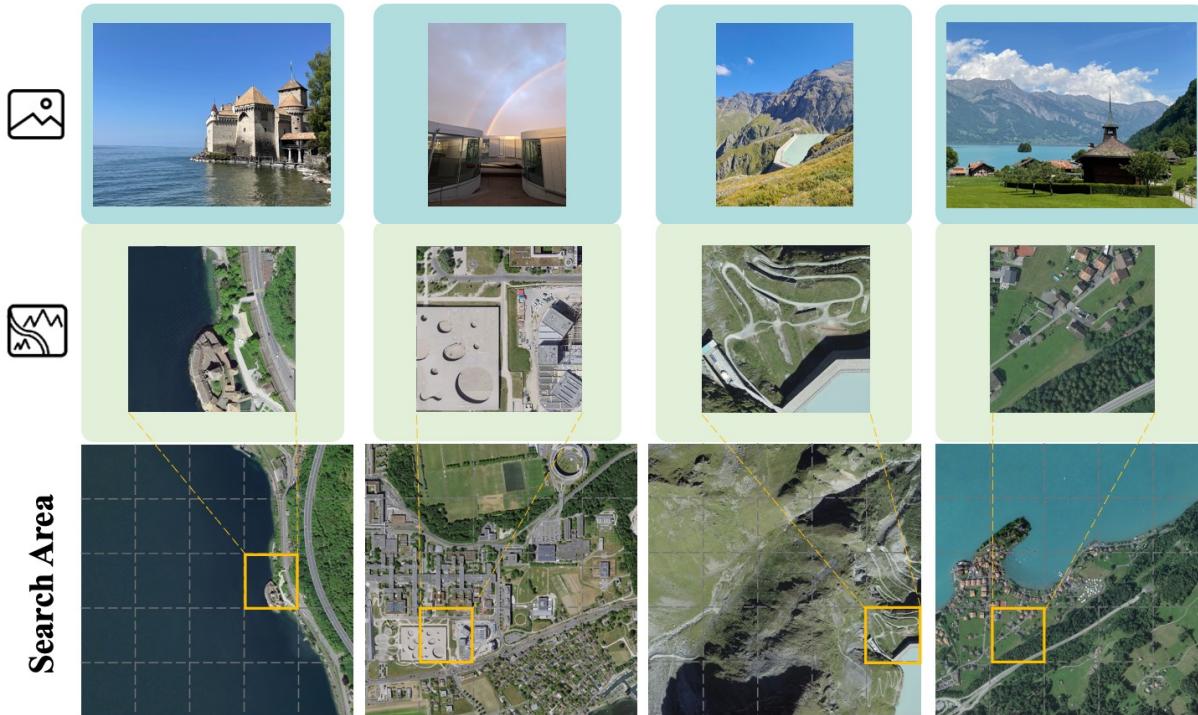


GeoExplorer shows improved **cross-domain and cross-modal generalization ability** over the baseline model with extrinsic reward only.

# 3. Results

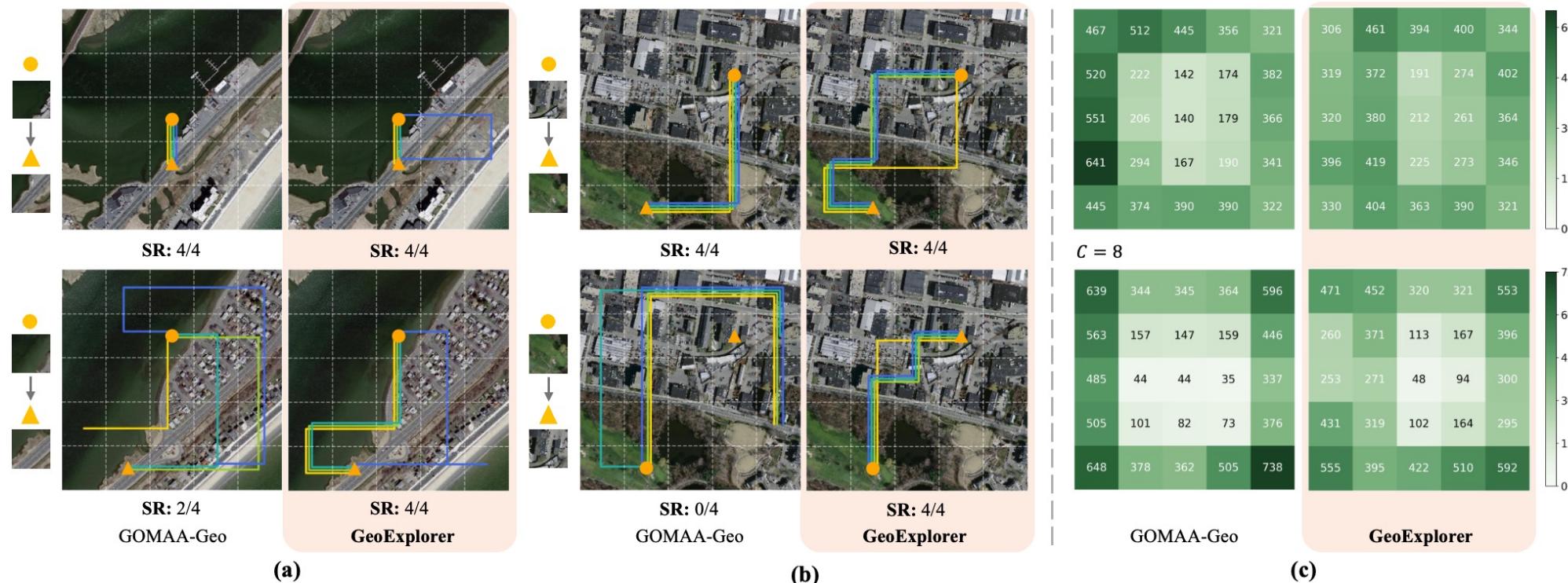
## ■ Unseen Target Generalization

GeoExplorer exhibits an impressive generalization ability in localizing unseen targets, especially when the path is long.



## 4. Does Intrinsic Reward Improve Exploration?

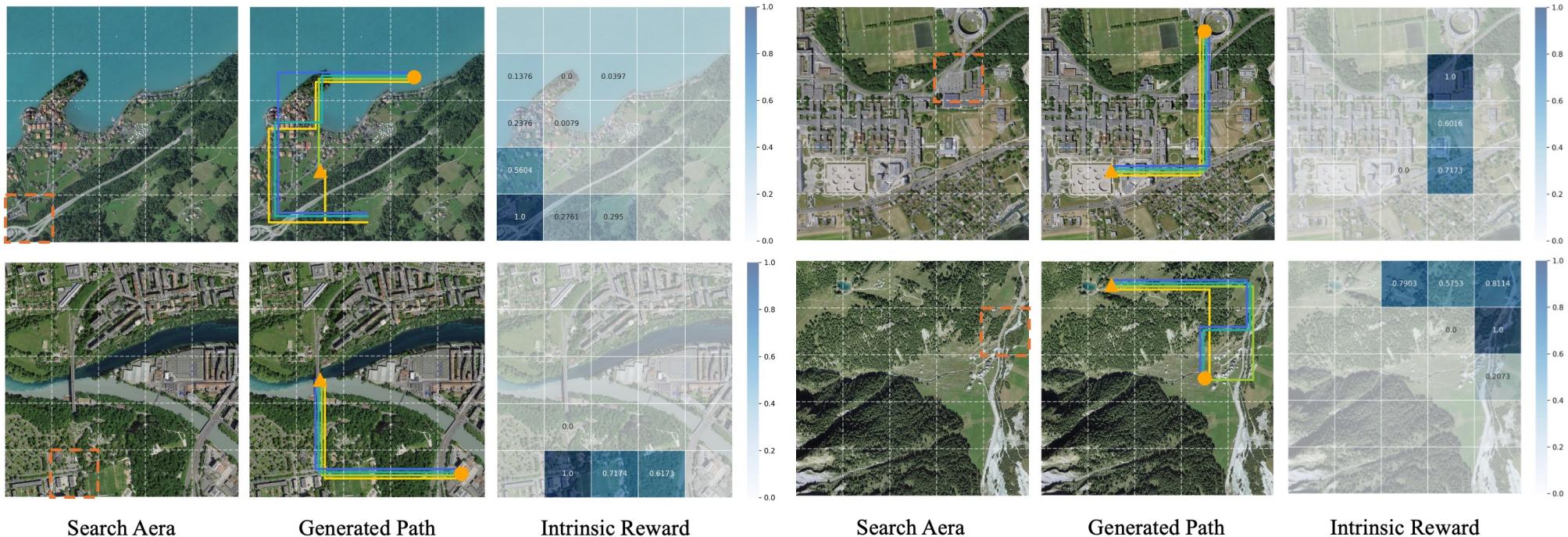
## ■ Visualization of Exploration Ability



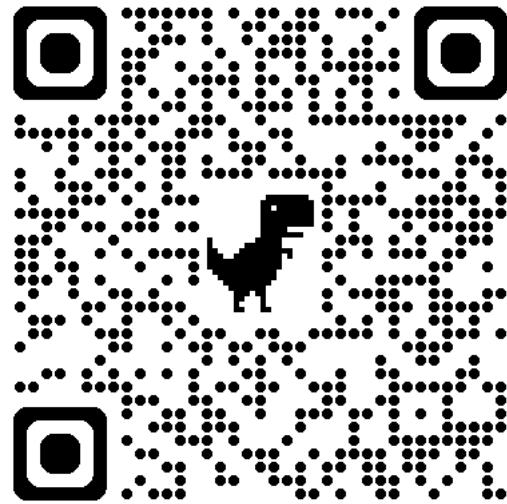
GeoExplorer shows **robust, diverse, and content-related exploration ability**.

# 4. Does Intrinsic Reward Improve Exploration?

## ■ Analysis of Intrinsic Reward



Curiosity-driven intrinsic rewards provide **dense**, **goal-agnostic**, and **content-related guidance** to enhance the exploration ability of GeoExplorer.



A trade-off between following the direct, goal-oriented guidance and **engaging in exploratory behavior**.

**Distance-based  
Extrinsic Reward**  
(i.e., previous methods)  
 $dist(Obs., Goal)$



**Curiosity-driven  
Intrinsic Reward**

$sim(Pred., Obs.)$



*Get closer to  
the goal*

*Explore the  
environment*