# QGIS plugins for Image Fusion and Image Imputation

by

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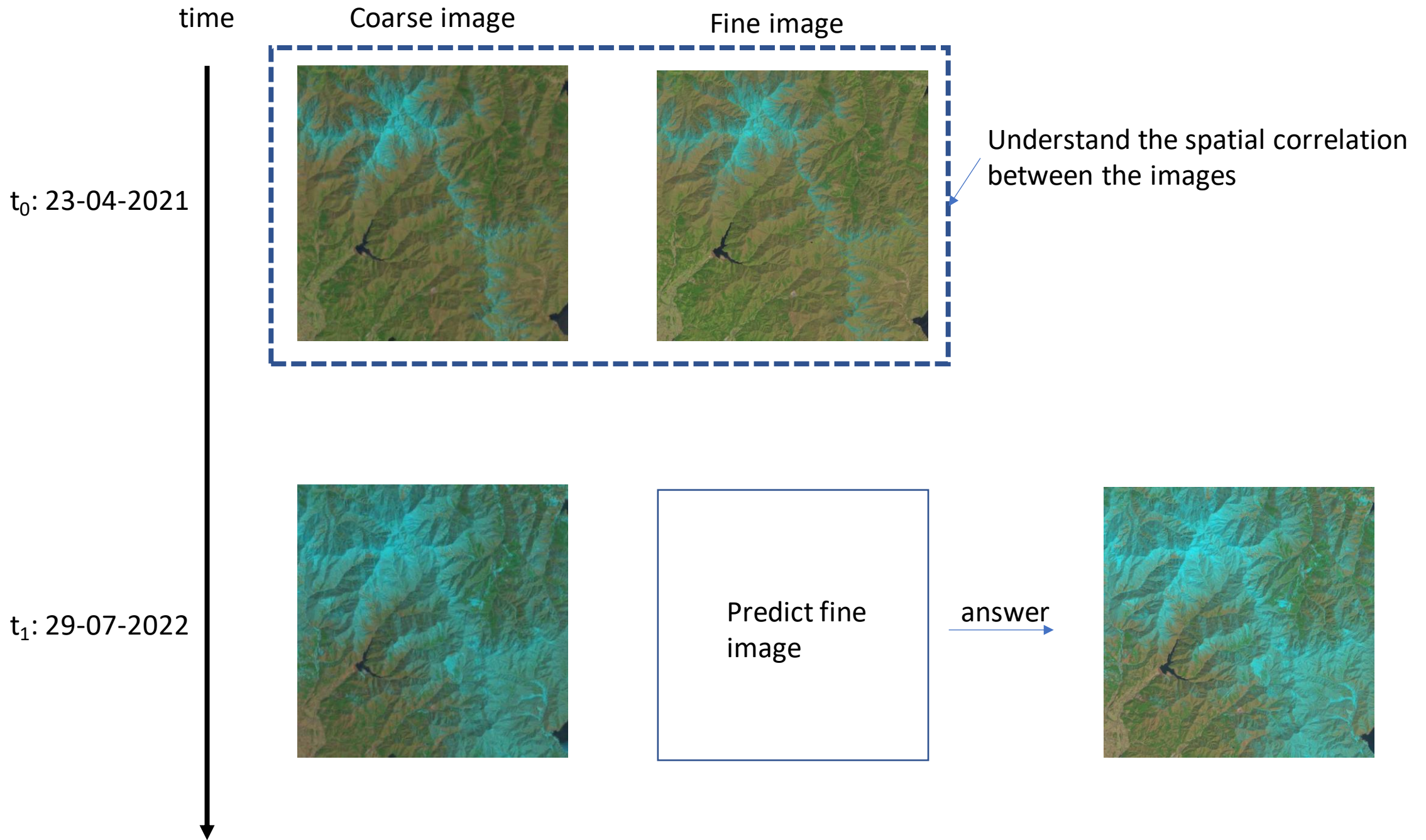udayrage@u-aizu.ac.jp

# Outline

- Part-1
  - Introduction to Image Fusion
  - Demo of our QGIS image fusion plugin
  - Future work

- Part-2
  - Introduction to Imputation
  - State-of-the-art techniques
  - Demo of our QGIS image imputation plugin
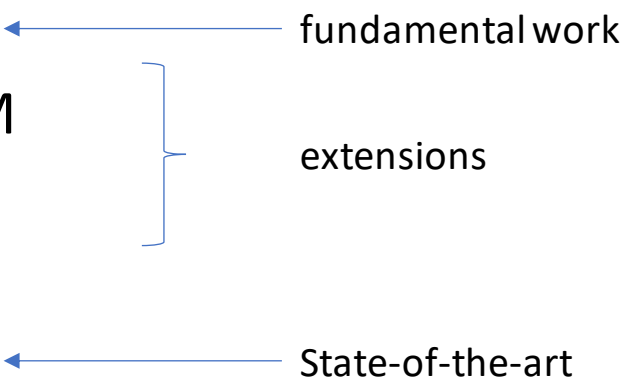  - Future work

# Part 1: Image Fusion

# Introduction

- ## Image fusion:
  1. Understanding the spatial correlation between the low-resolution and high-resolution images of a particular location and
  2. Generate a higher-resolution image for a given low-resolution image taken later.

time

Coarse image

Fine image

Understand the spatial correlation between the images

$t_0$: 23-04-2021

$t_1$: 29-07-2022

Predict fine image

answer

# Related Works

- Existing approaches

  - **STARFM** ← fundamental work

  - ESTARFM

  - SPSTFM

    extensions

  - ...

  - <u>**HISTIF**</u> ← State-of-the-art

- **Improved HISTIF**   *(our algorithm published in IEA-AIE 2022)*

Limitations

geo-registration errors
(preserve shape but loose spatial details)

tolerant to geo-registration errors
but suffers from bias

# Demo: QGIS Plugin for Image Fusion
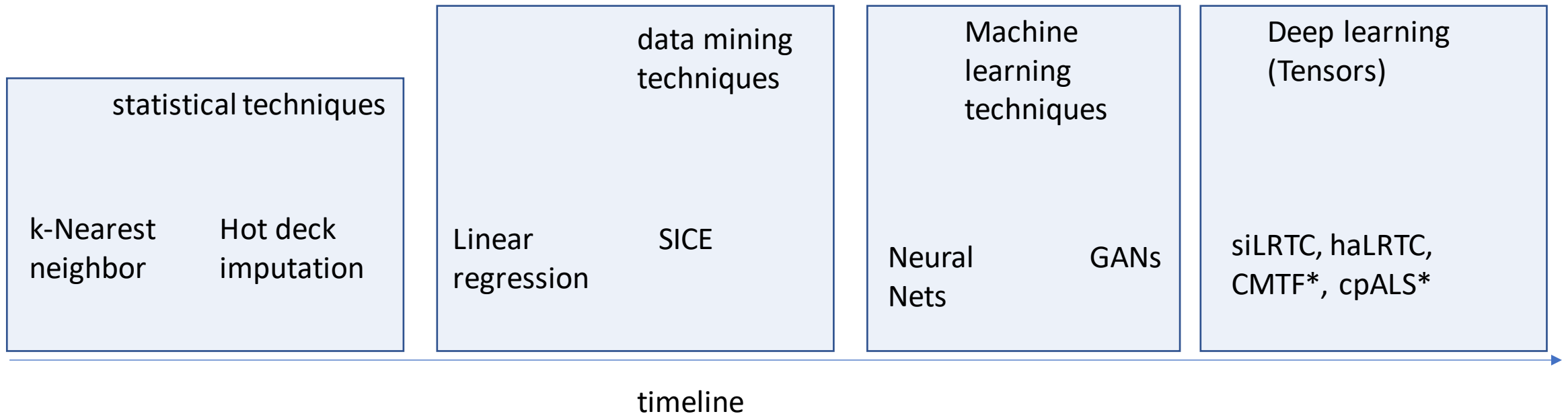
Bandi Mountain Data

# Future Work

- The IHISITF algorithm is a sequential algorithm relying on a single CPU.

- We are developing parallel and distributed solutions for IHISTIF using multiple CPU cores.

- We are also exploring new Image fusion techniques.
  - Our new technique submitted to DASFAA 2022 improves over IHISITF by 10 to 20%.

# Part 2: Image Imputation

# Introduction

- Missing pixels is a fundamental problem in image analytics.

- **Imputation** is a technique employed to fill up the missing pixels.

- K-Nearest Neighbor is the widely adopted basic imputation technique.

- However, much better imputation techniques have been recently proposed in the field of Computer Science

# State-of-the-art techniques

| statistical techniques | data mining techniques | Machine learning techniques | Deep learning (Tensors) |
|---|---|---|---|
| k-Nearest neighbor    Hot deck imputation | Linear regression        SICE | Neural Nets        GANs | siLRTC, haLRTC, CMTF*, cpALS* |

timeline

* state-of-the-art

# Demo: QGIS Plugin for Image Imputation

# Future Works

- Existing Tensor-based imputation techniques do not include humans in the decision-making process.

- We are developing novel tensor-based imputation techniques by incorporating the "human-in-the-loop" concept.
  - The user will input the missing imagery data.
  - The user will also tell the technique of which data to be considered for model building.
  - Our model will learn the data specified by the user and perform imputation.
  - Preliminary results demonstrate that we can improve the performance by 10%.

# The END

Thank you and questions