

Deep Learning for Remote Sensing

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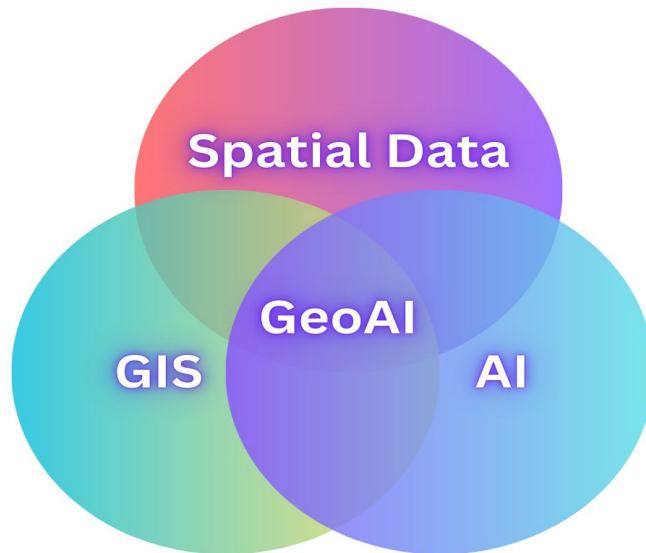
09.01.2025

- Introduction
- Semantic Segmentation
- Change Detection
- Image Translation
- Domain Adaptation
- Conclusion

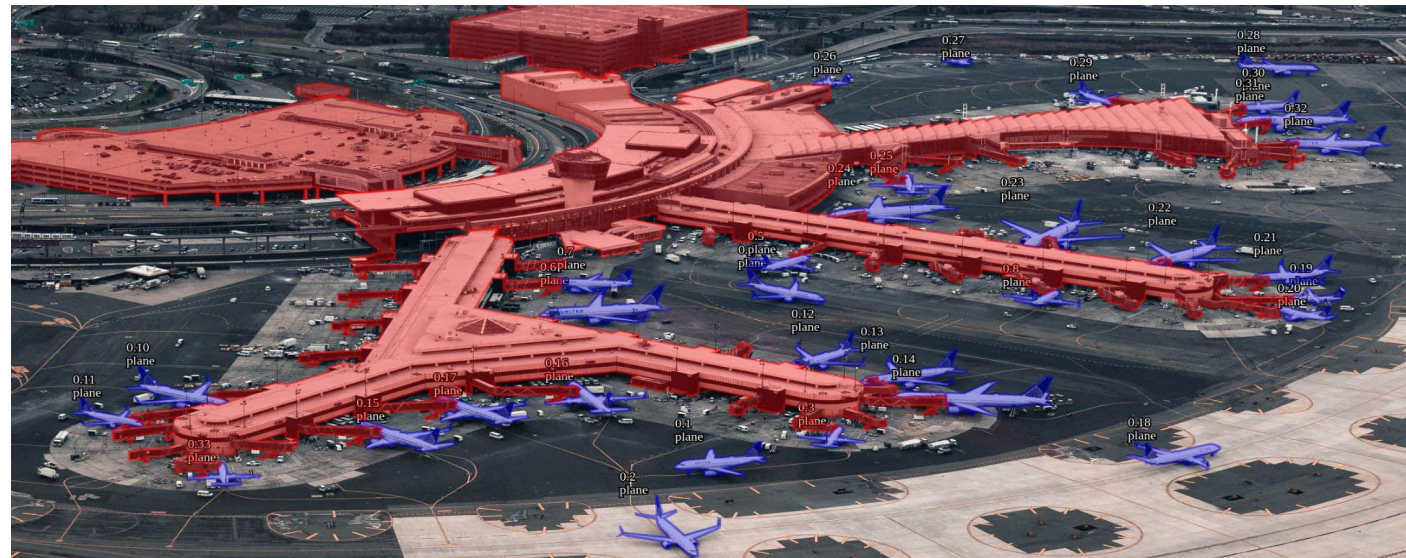
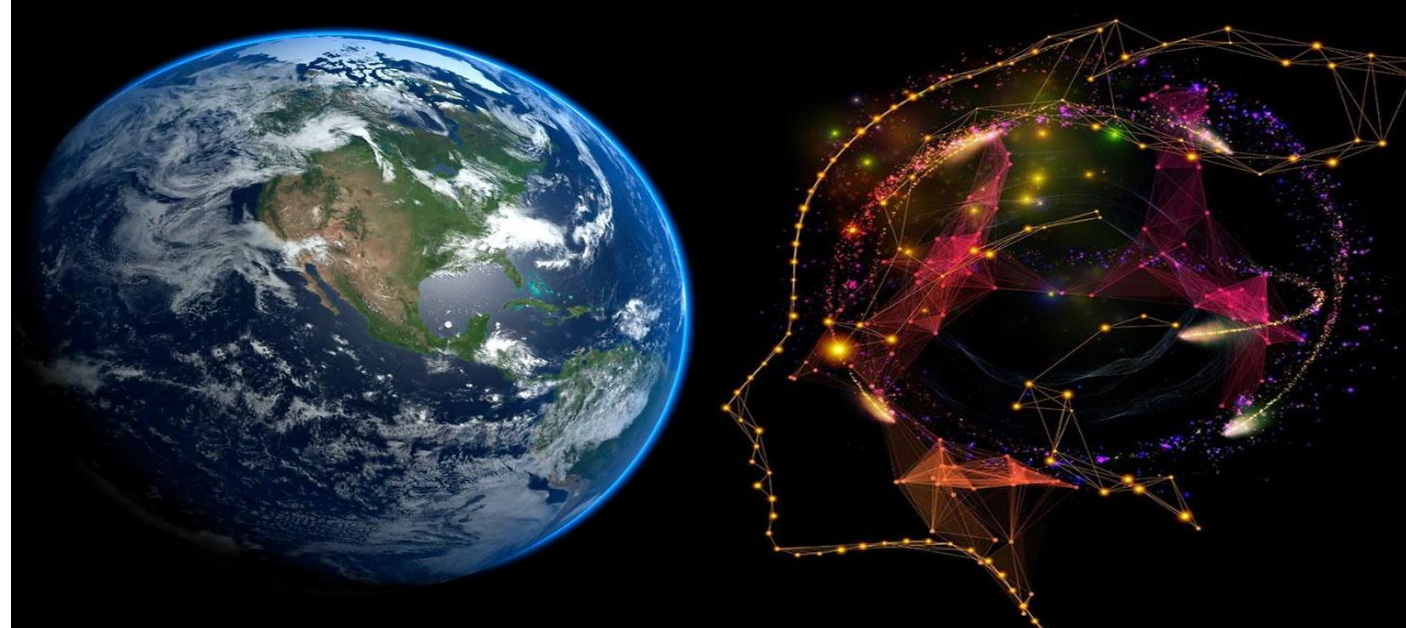
Introduction

GeoAI

- ACM SIGSPATIAL 2017
- Geospatial + AI
- Spatial Data + GIS + AI

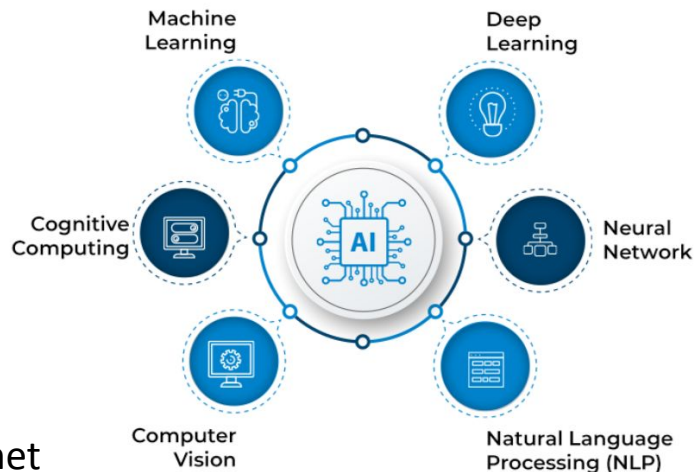


Source: Internet



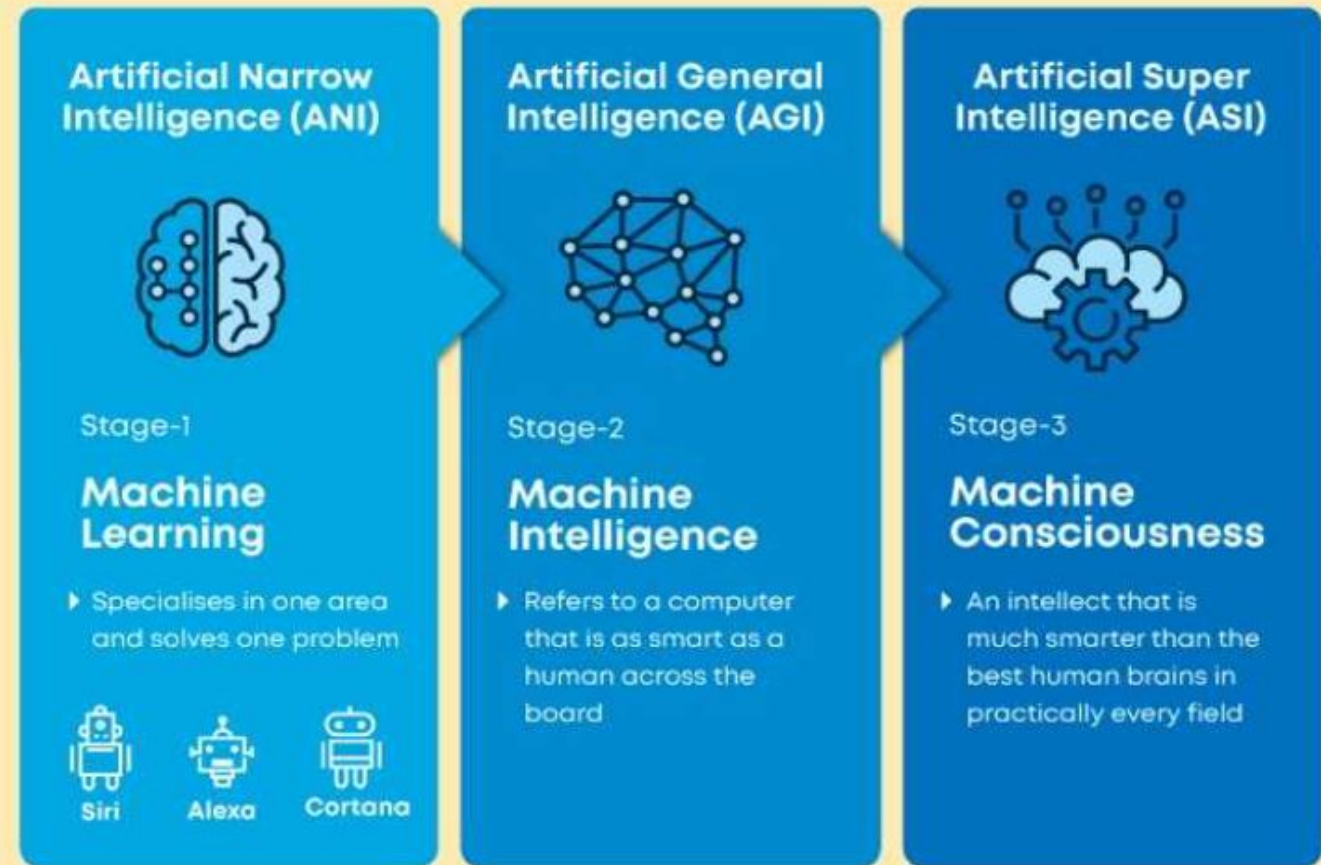
Introduction

- Mimic human intelligence
- Vision analysis
- NLP
- Facts based Analysis
- Decision Making



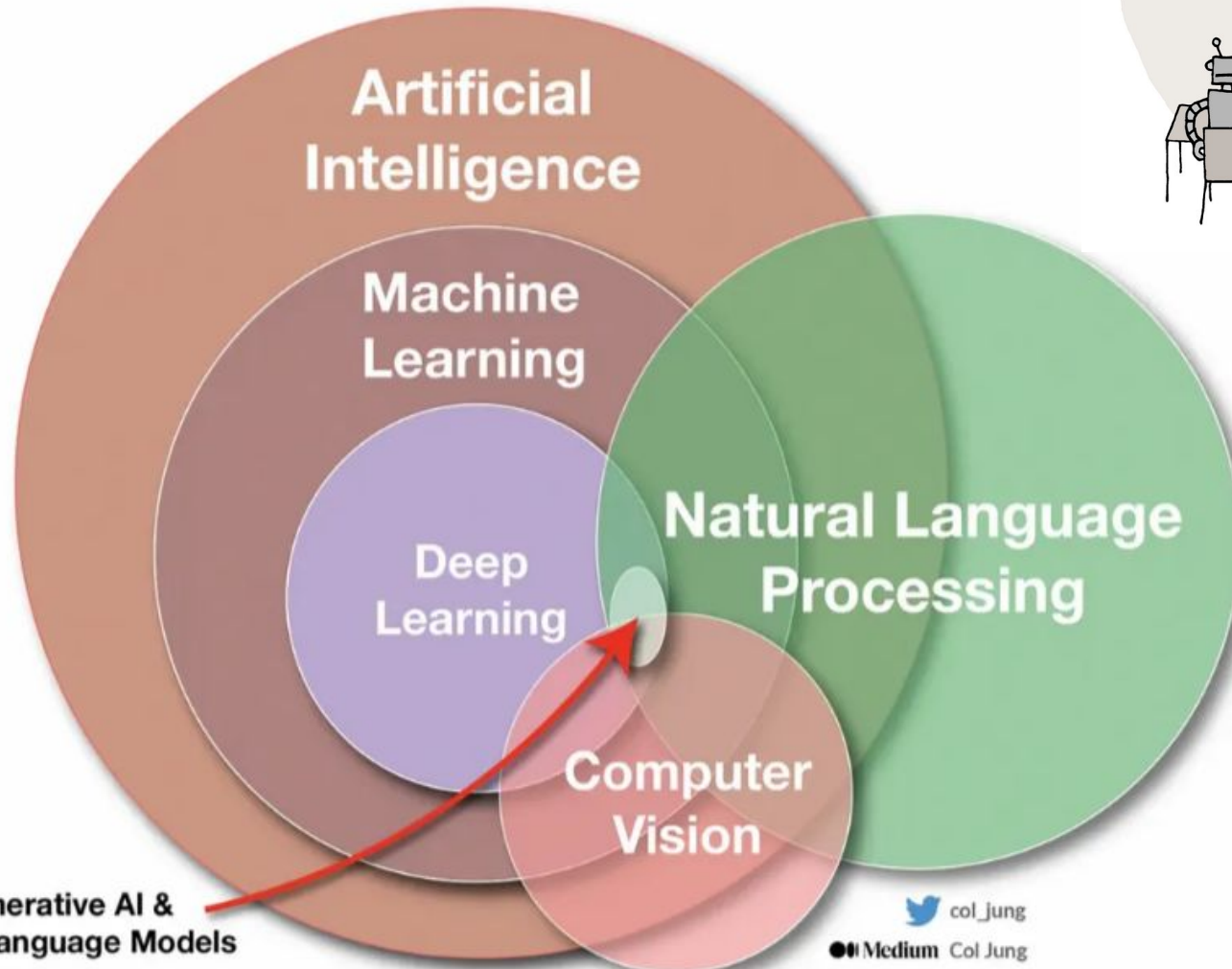
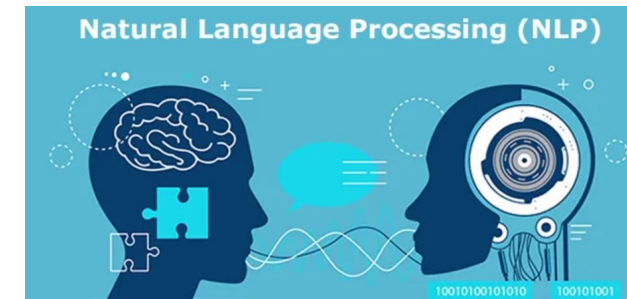
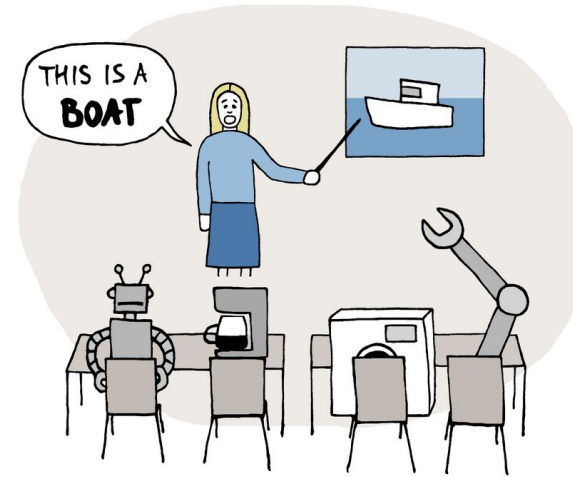
Source: Internet

3 Types of Artificial Intelligence



Introduction

MACHINE LEARNING



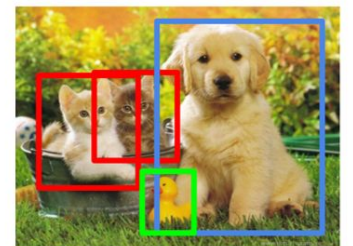
Generative AI &
Large Language Models

Classification



CAT

Object Detection



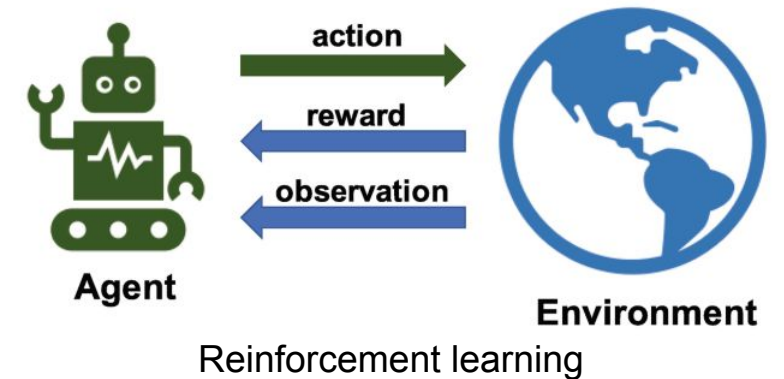
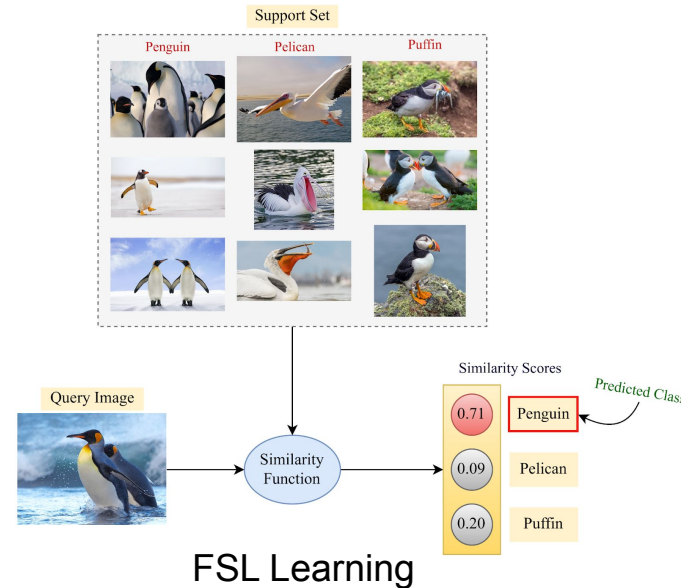
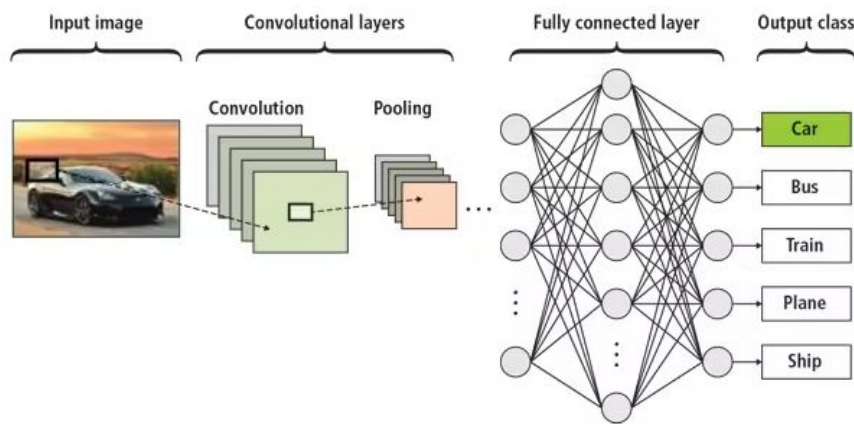
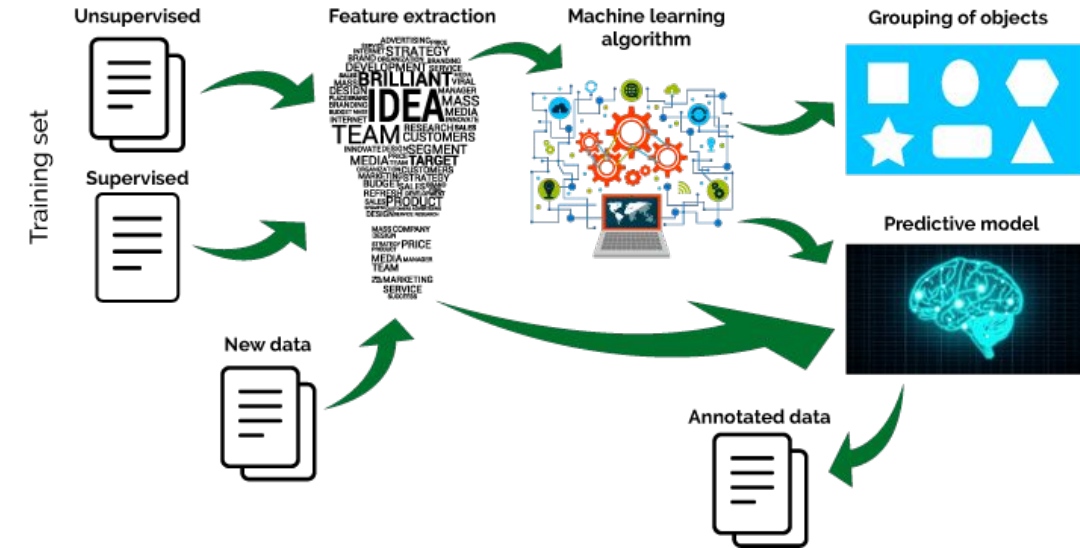
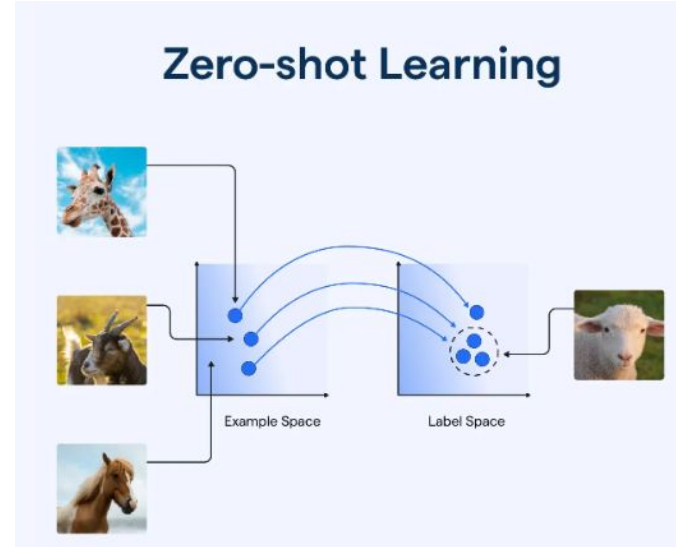
CAT, DOG, DUCK

Computer vision

Source: Internet

Introduction

- Supervised
- Unsupervised
- Reinforcement
- **Semi supervised**
- ZSL/FSL
- **Transfer**
- Feature
- ...

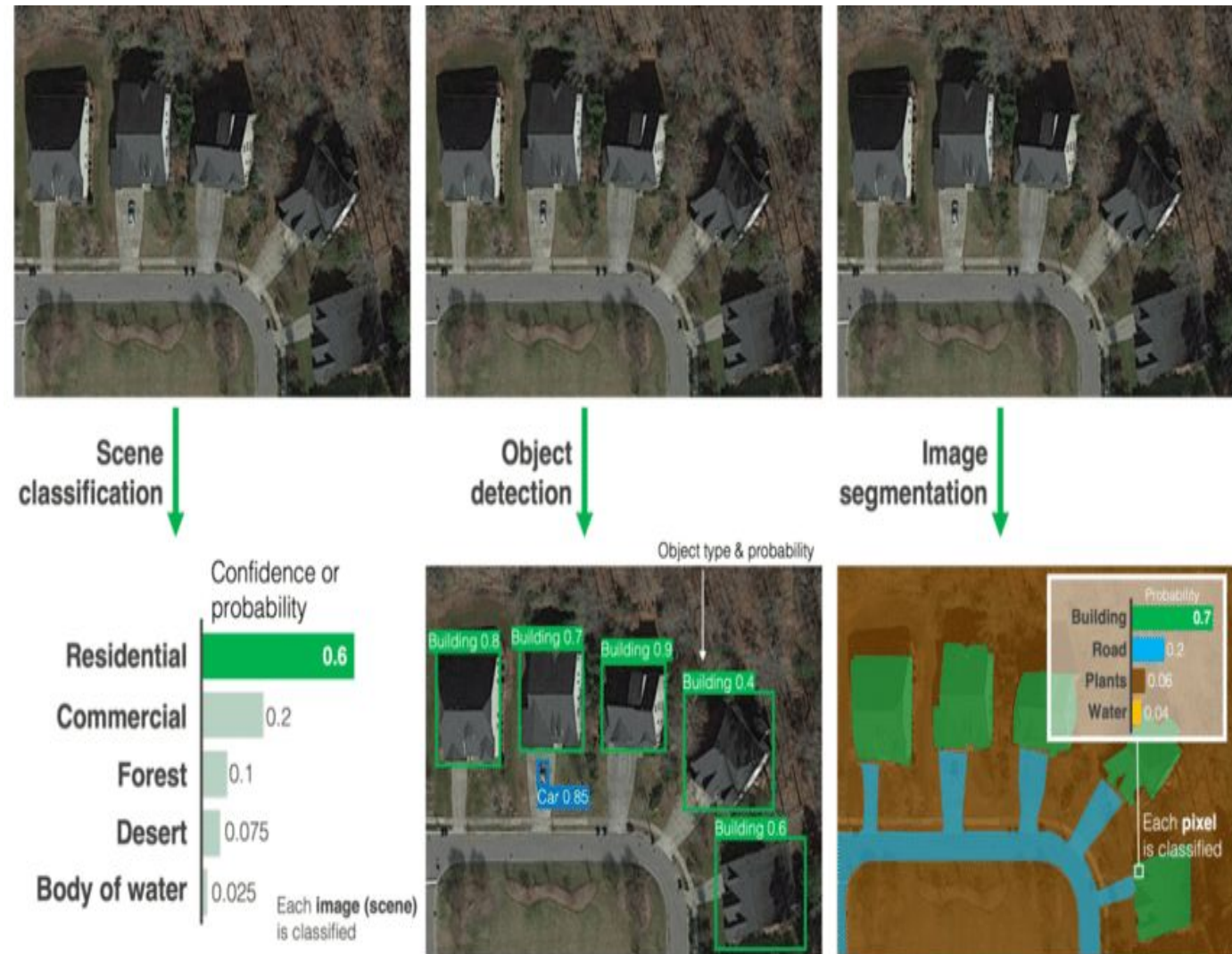


Source: Internet

Introduction

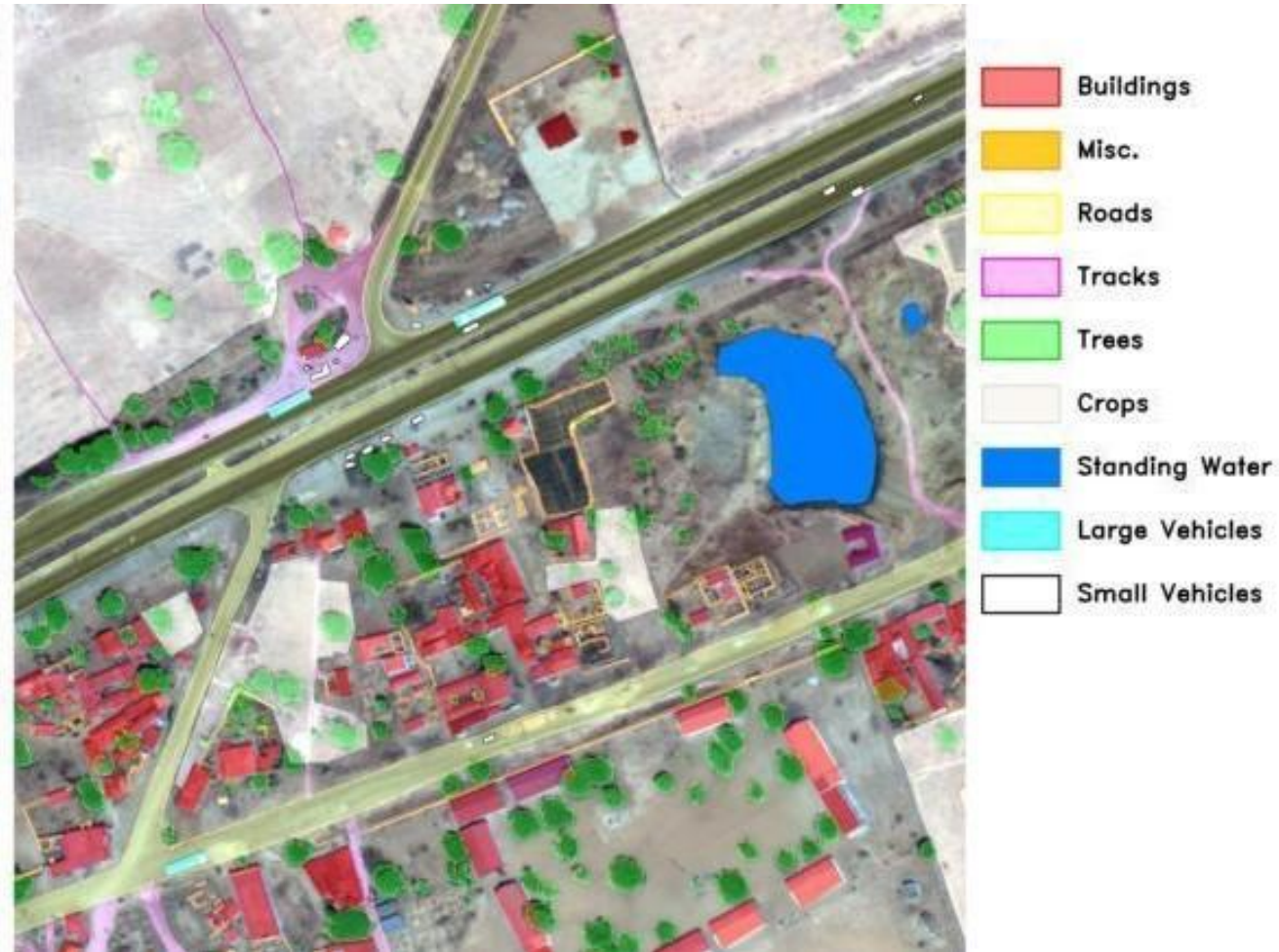
Remote Sensing Vision Tasks

- Image Classification
- Semantic Segmentation
- Change Detection
- Super Resolution
- Image Translation
- Image Fusion
- ...



Source: Ren et al. 2022

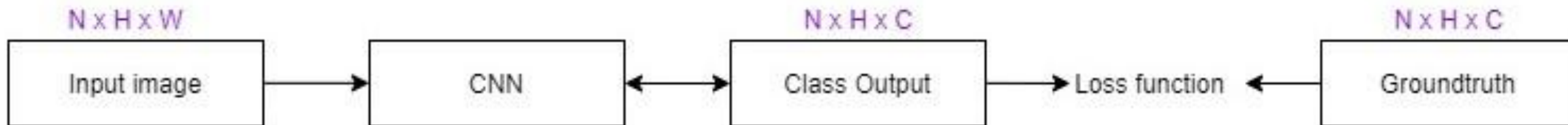
Semantic Segmentation



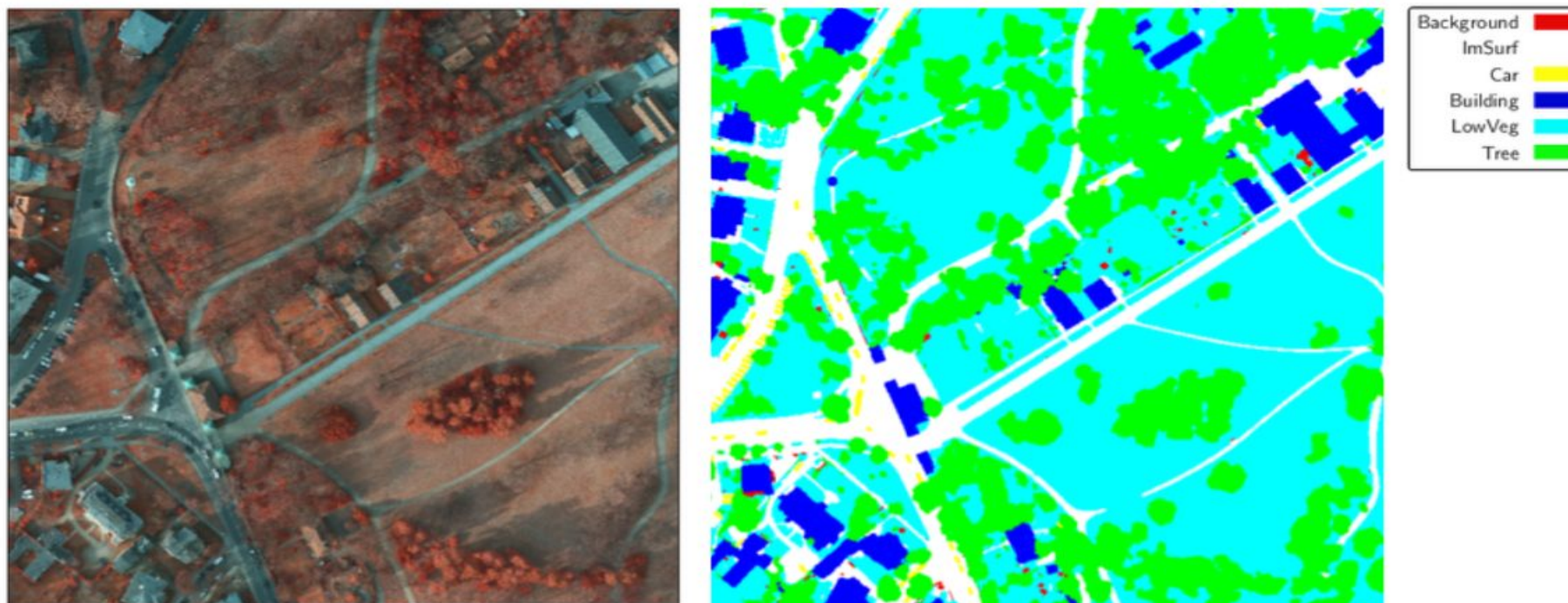
Visualization of semantic segmentation task

Source: DSTL dataset

Semantic Segmentation

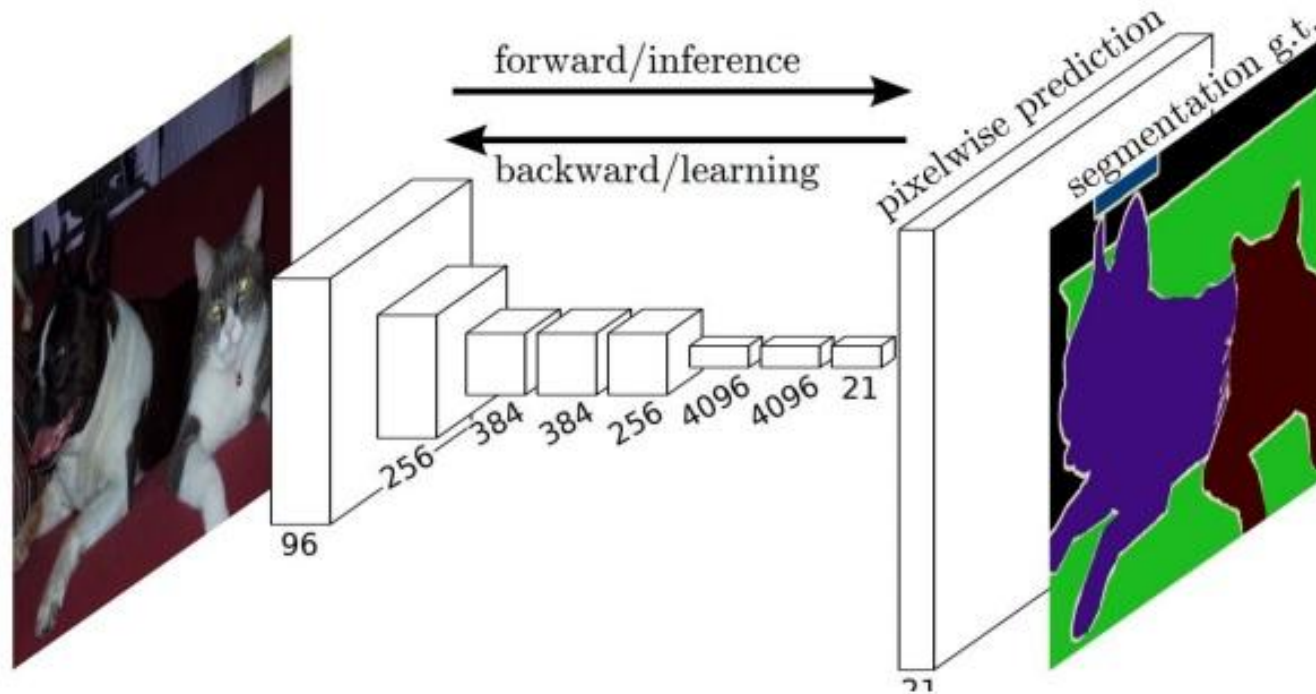


Workflow of semantic segmentation task



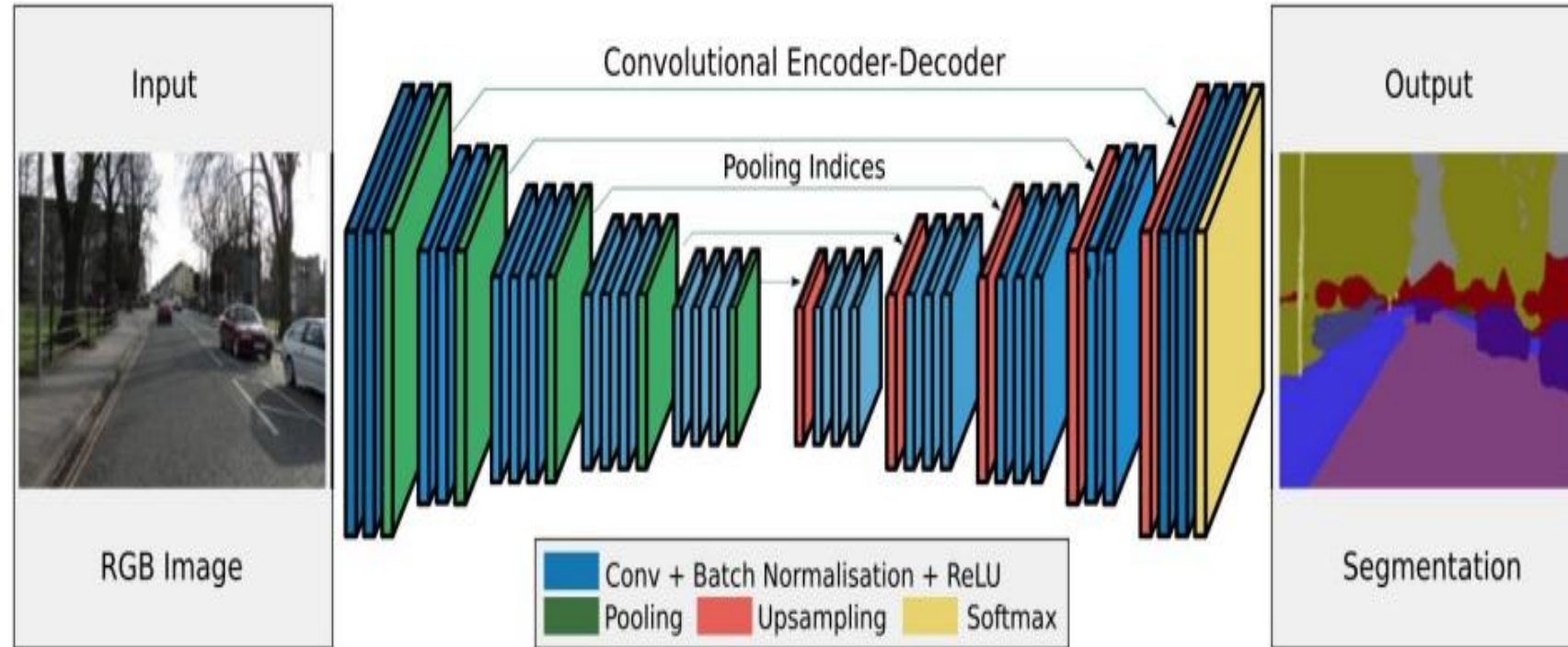
Visualization of Potsdam dataset

Semantic Segmentation



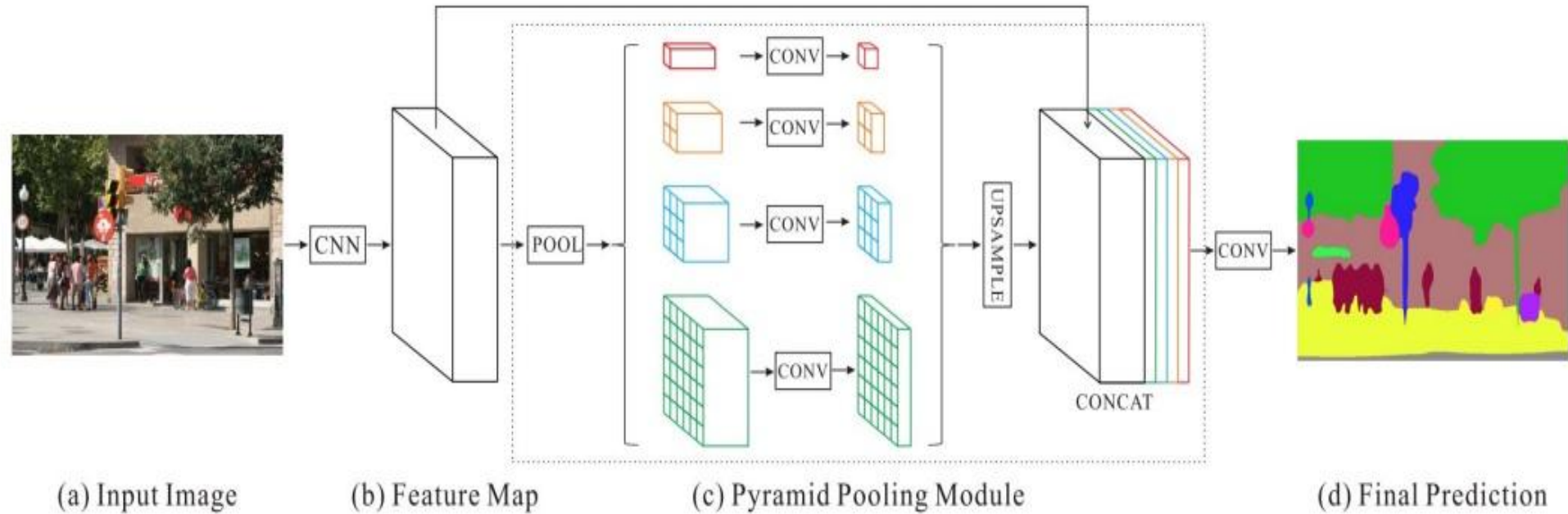
Encoder Decoder

Semantic Segmentation



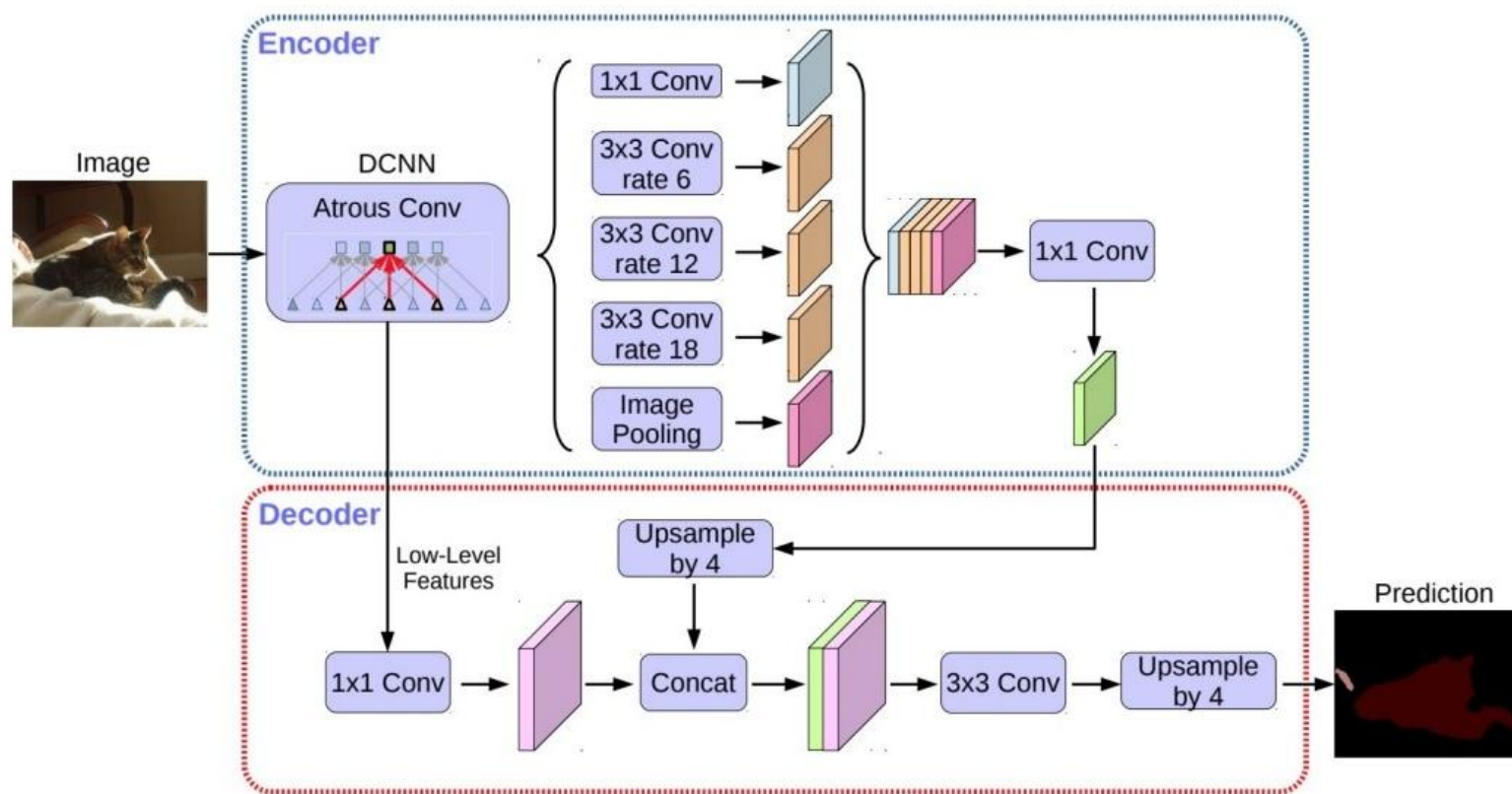
SegNet

Semantic Segmentation



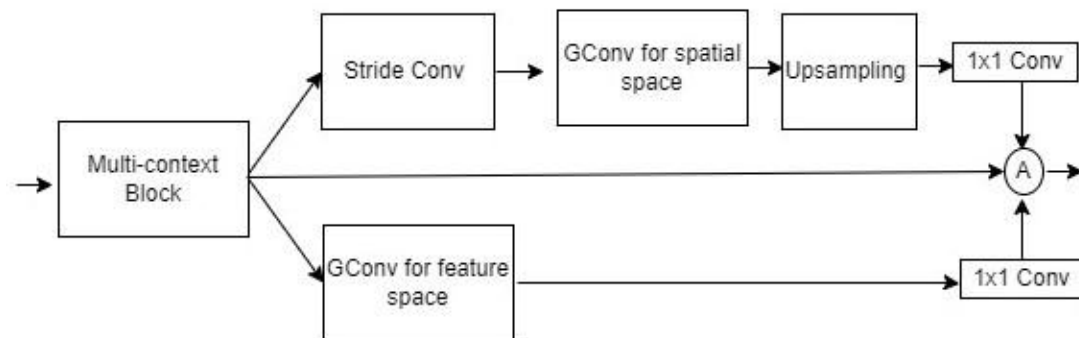
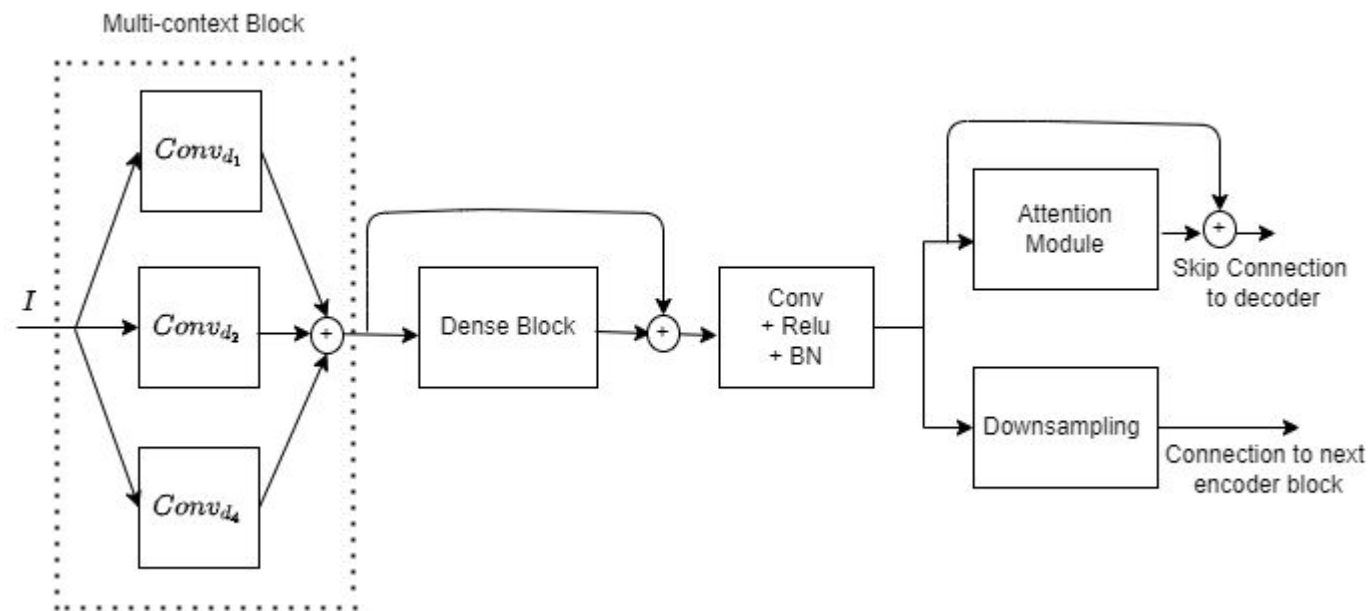
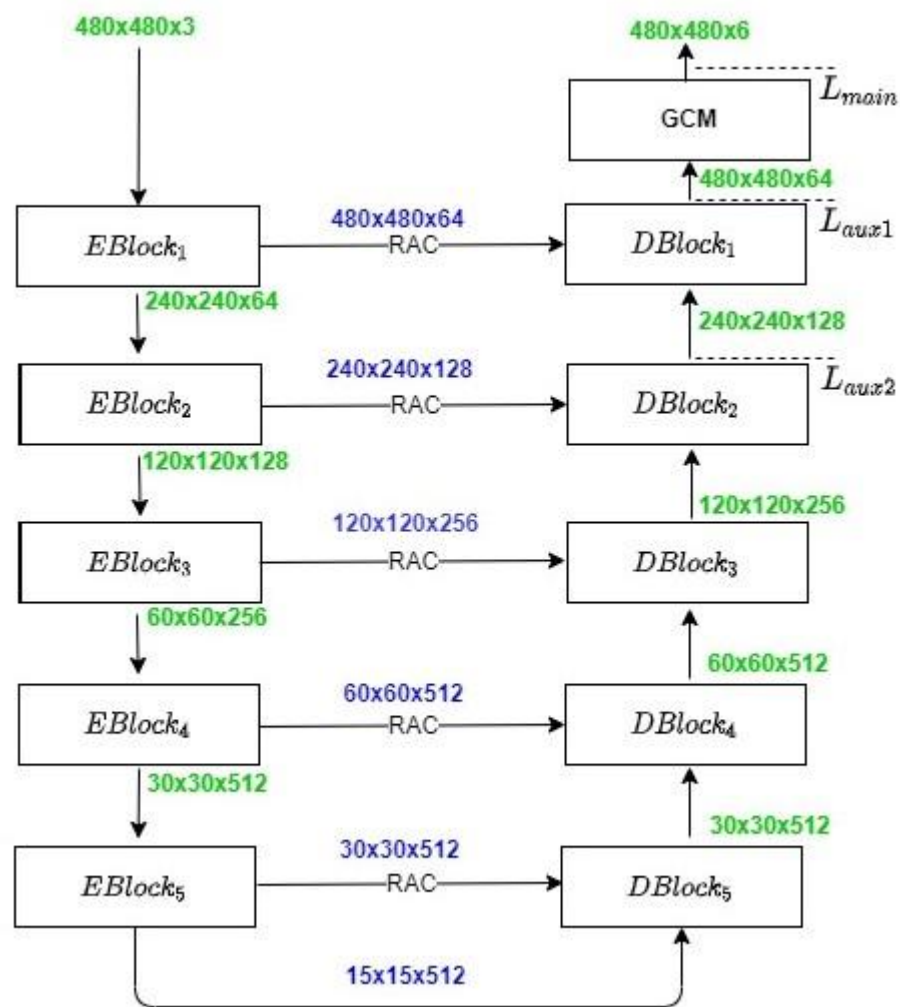
Pyramid pooling based

Semantic Segmentation



Dilated convolution based

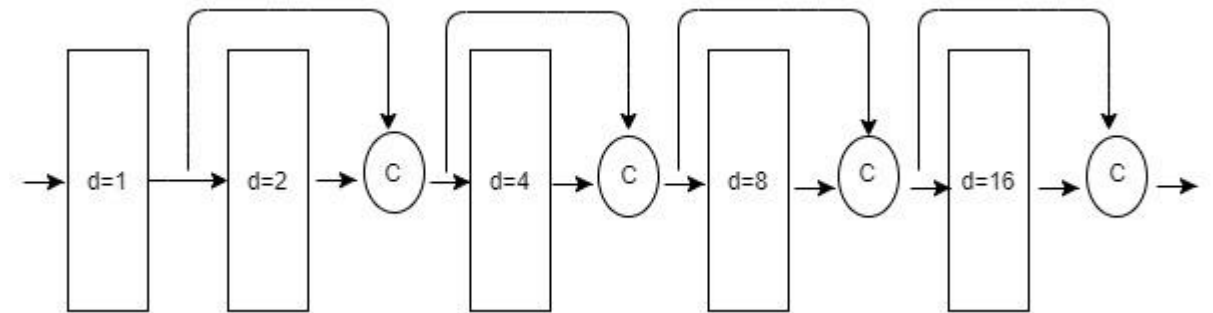
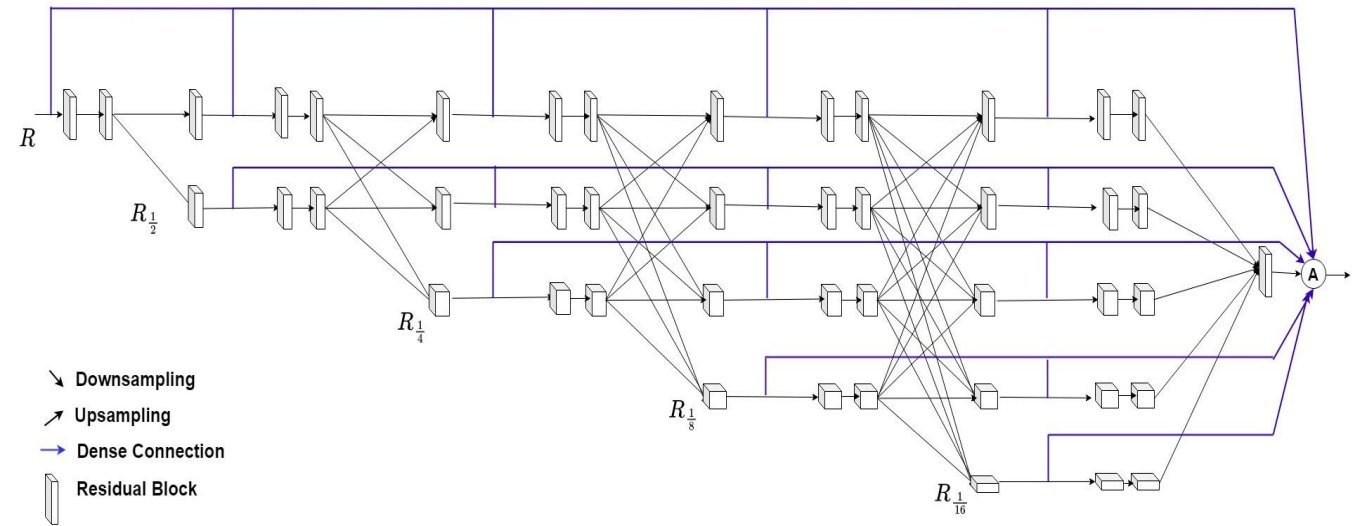
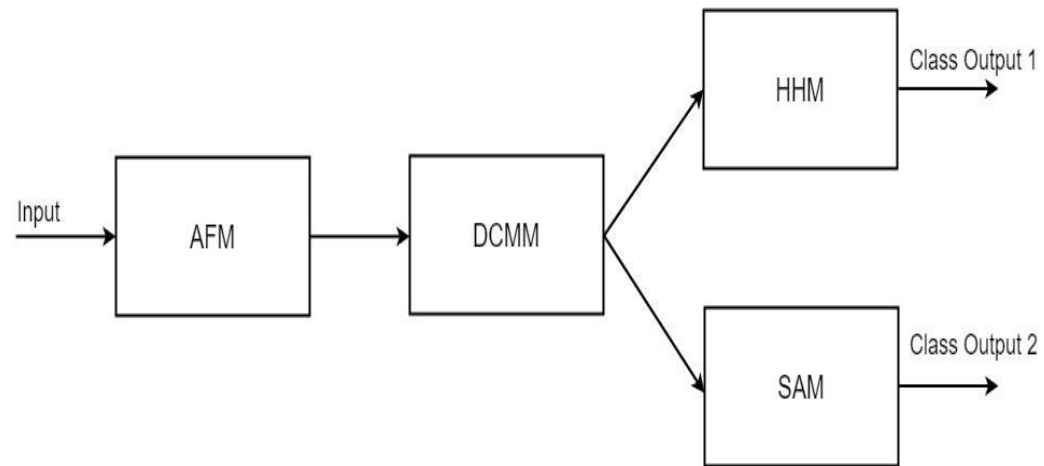
Semantic Segmentation



ACNet

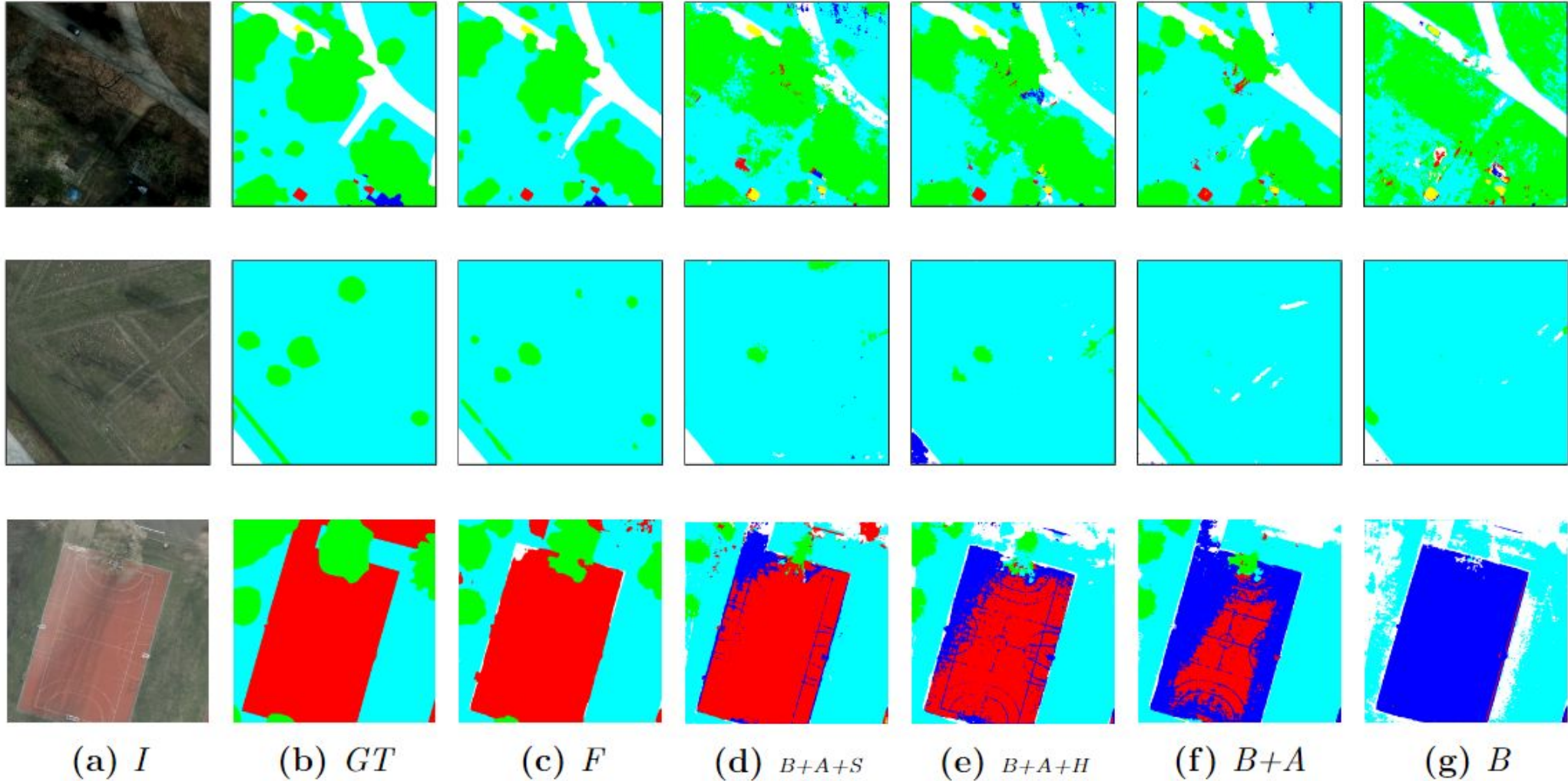
Source: Chouhan et al. 2022

Semantic Segmentation



HybridNet

Semantic Segmentation



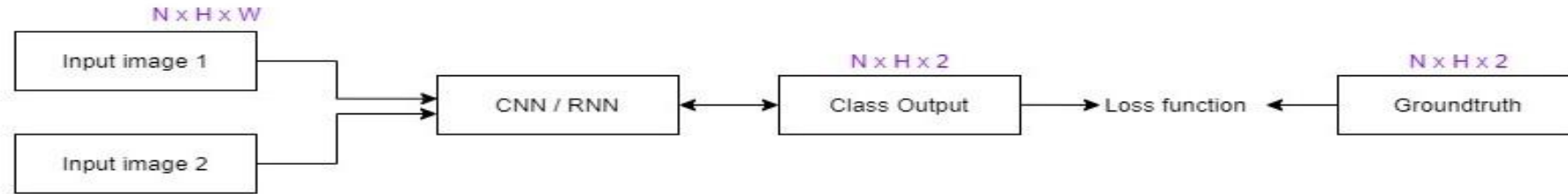
Ablation results

Change Detection

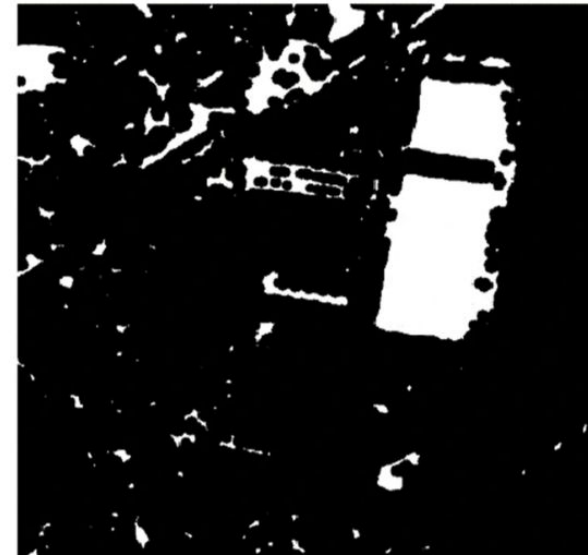


Visualization of change detection task

Change Detection

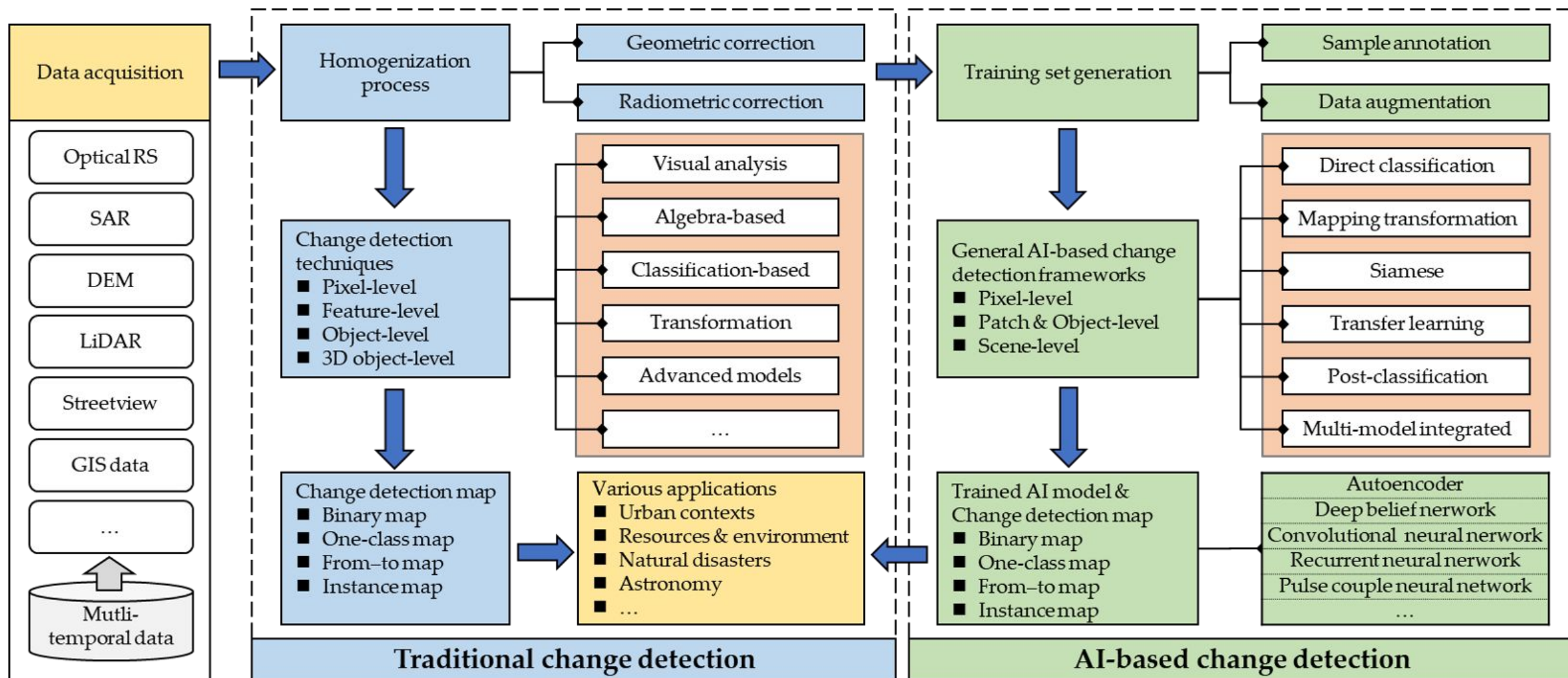


Workflow of change detection task



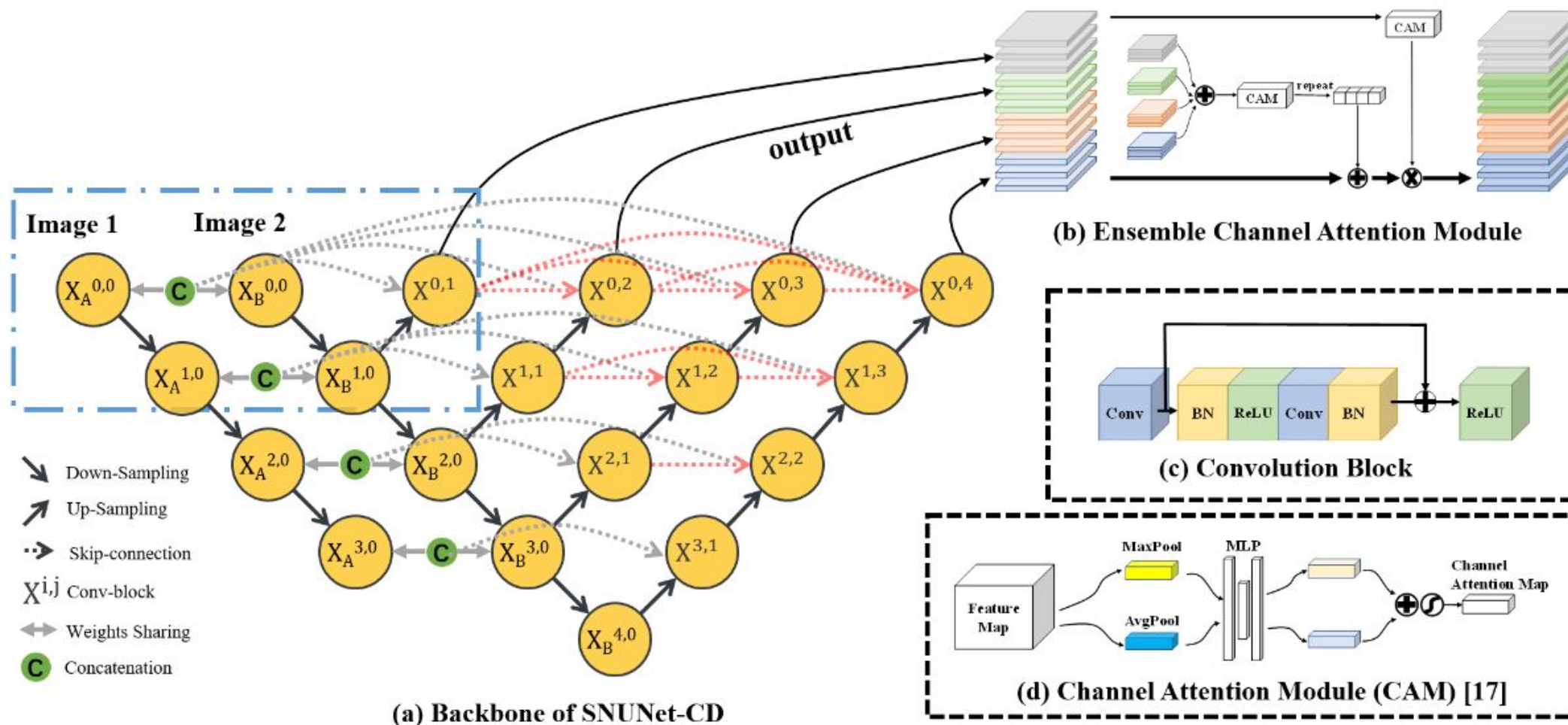
Visualization of change detection

Change Detection



Change detection algorithms

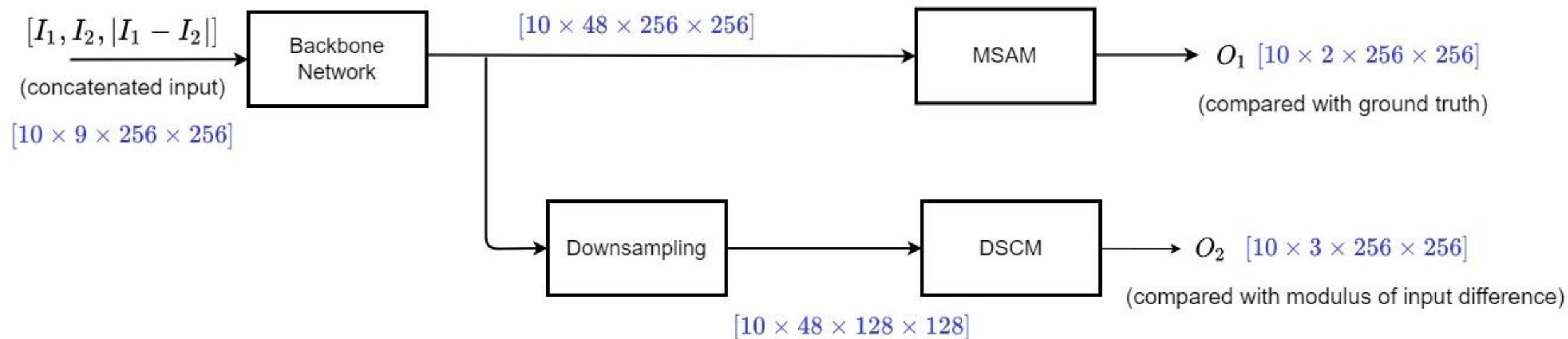
Change Detection



SNUNet

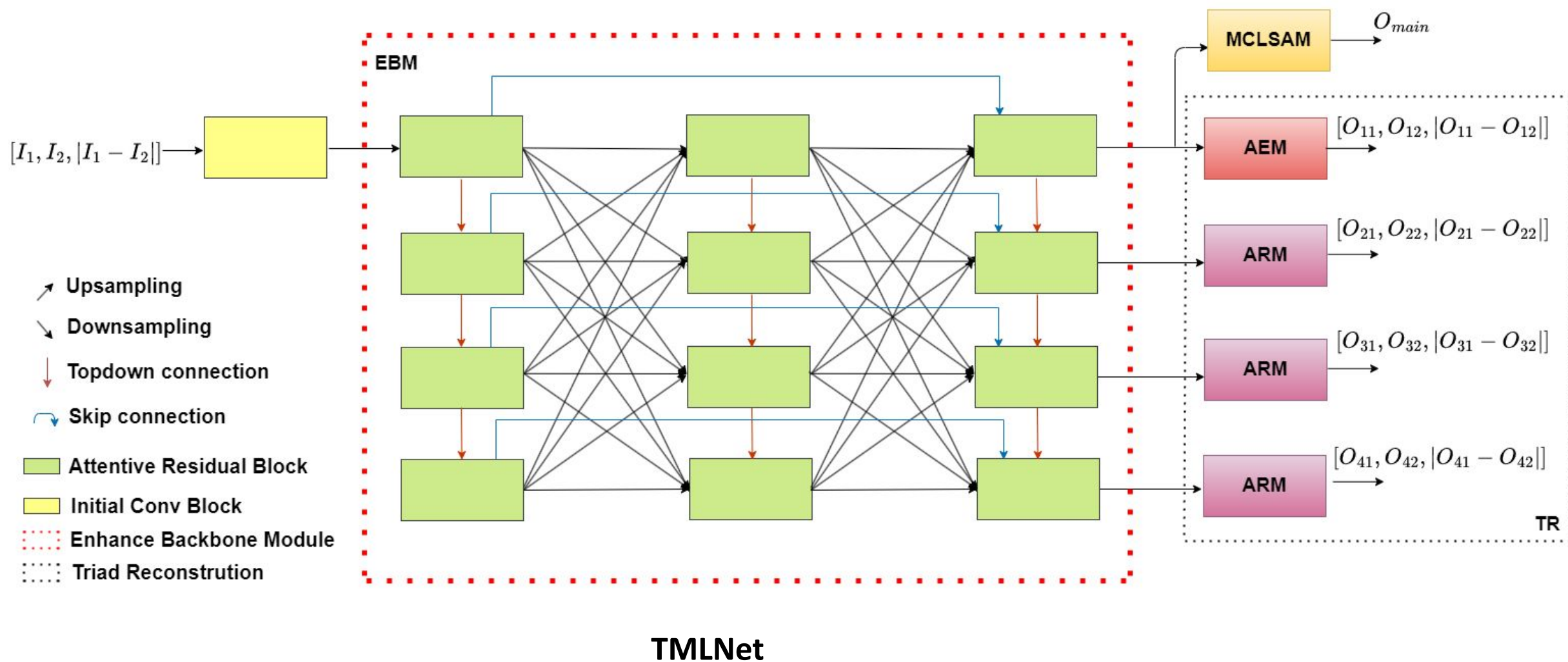
Source: Feng et al. 2021

Change Detection



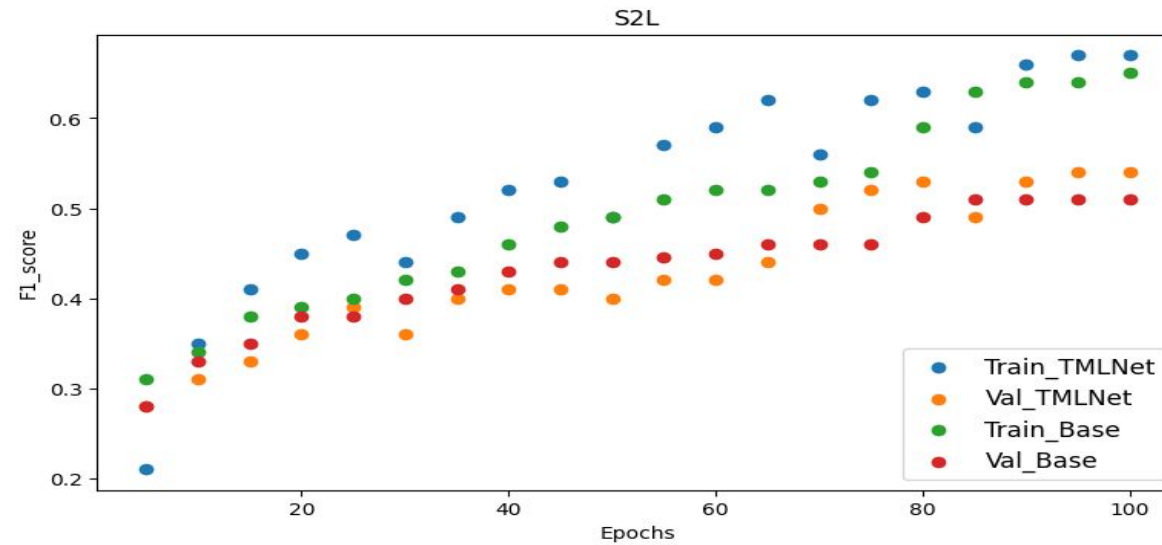
DRMNet

Change Detection

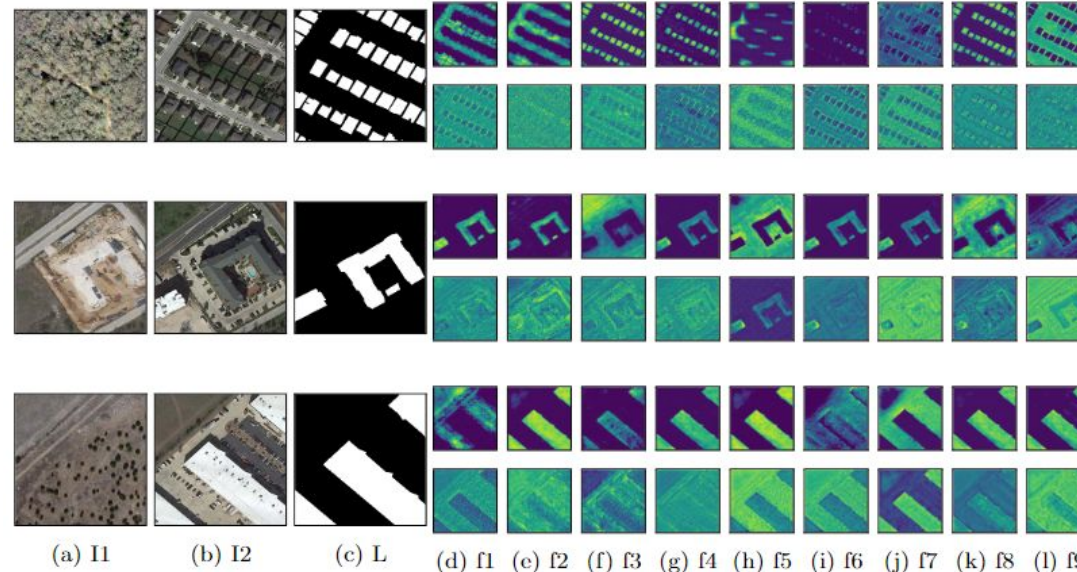


Source: Chouhan et al. 2024

Change Detection

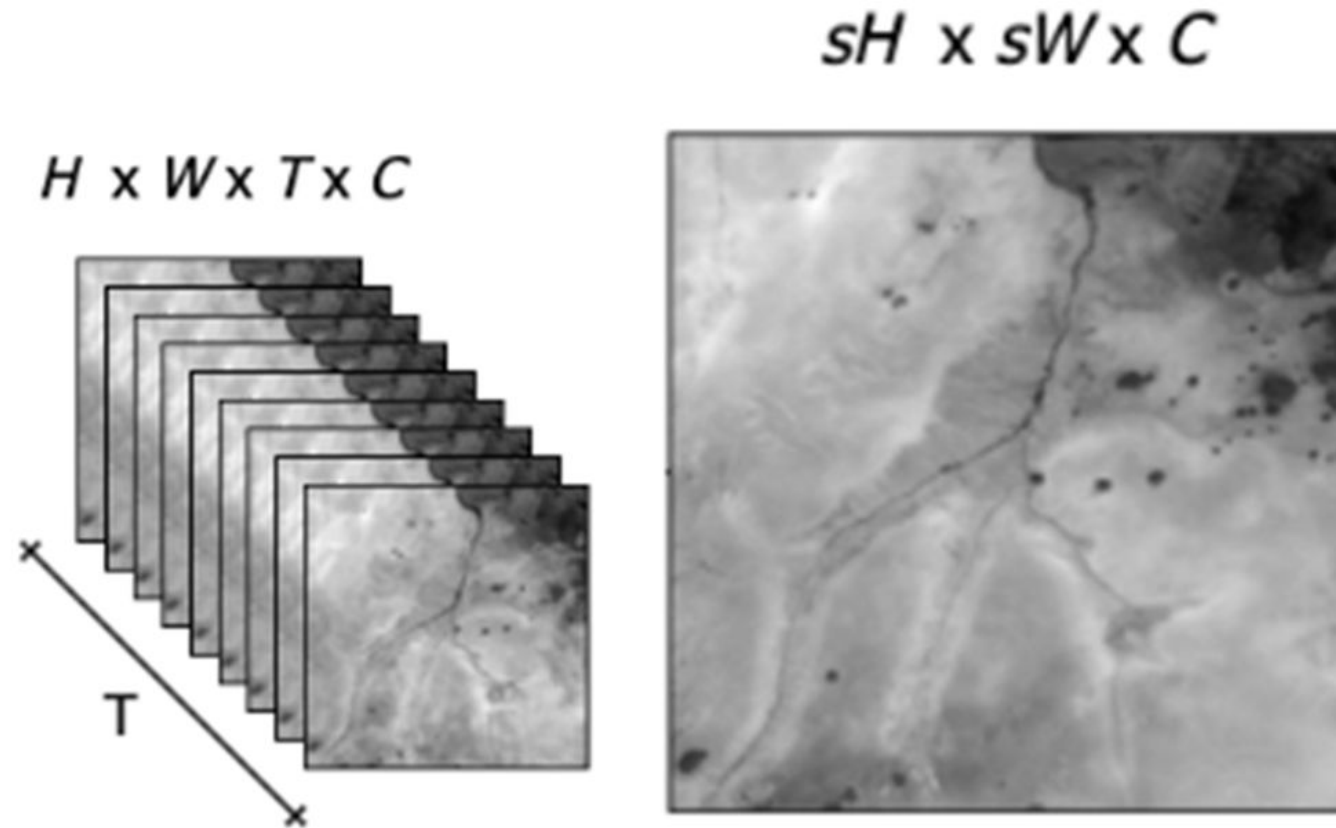


Overfitting Analysis



Source: Chouhan et al. 2024

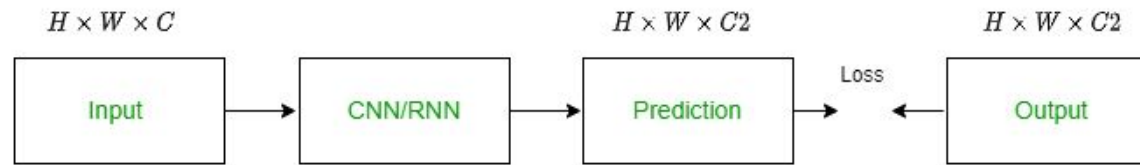
Image Translation



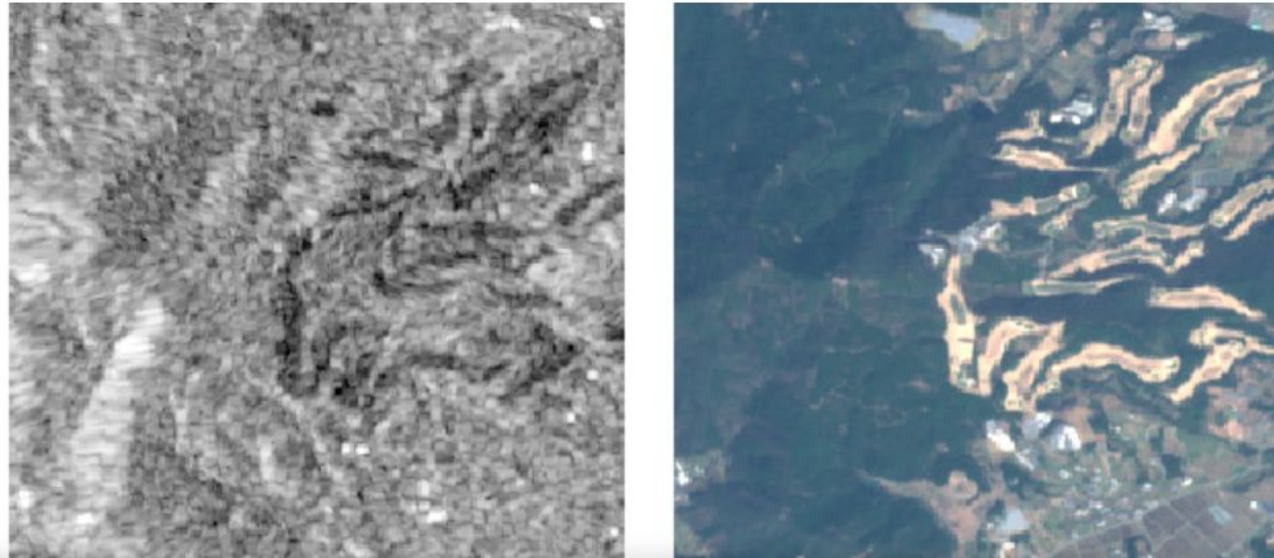
Visualization of super resolution task

Source: PROBA dataset

Image Translation



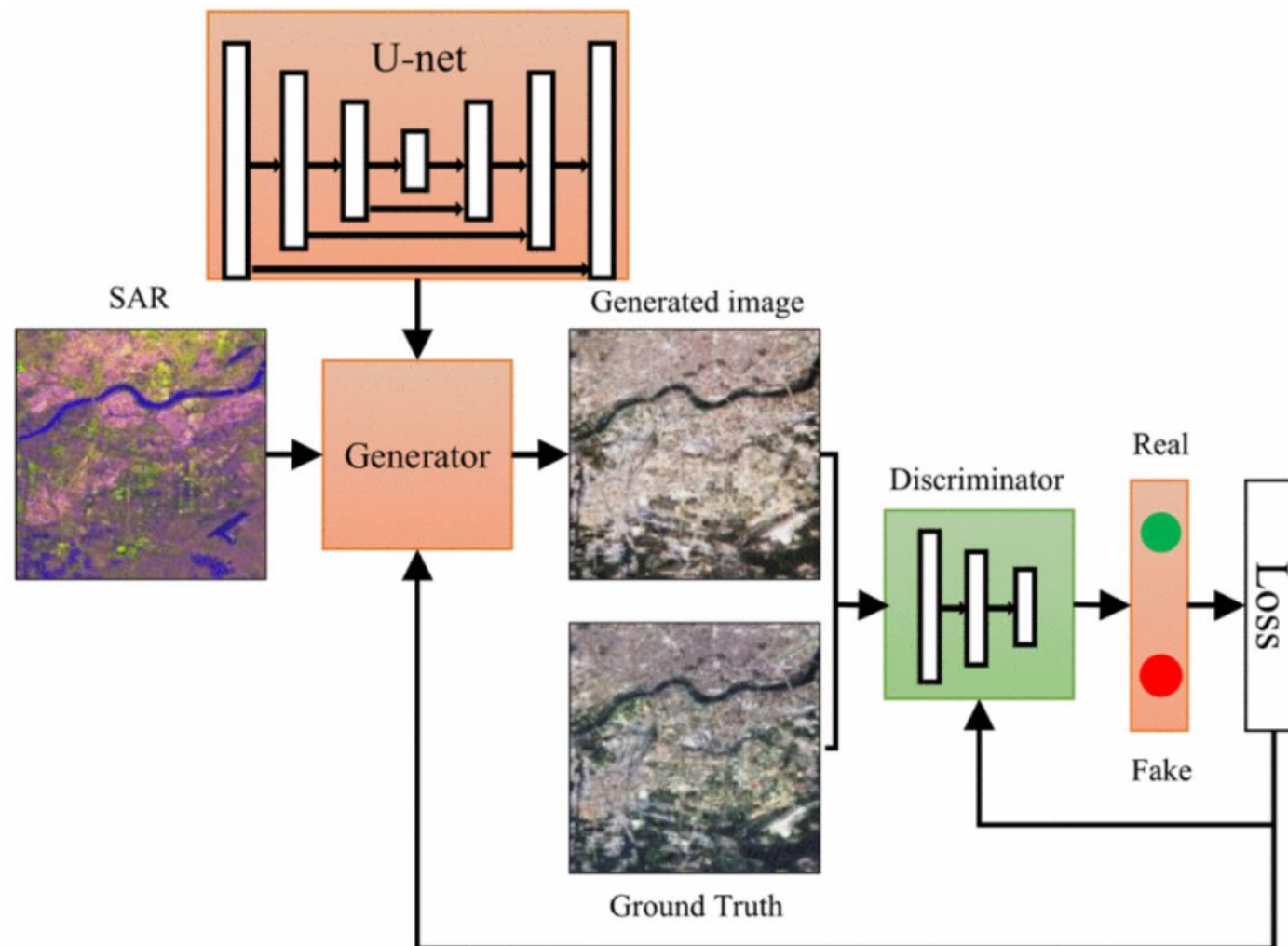
Workflow of image translation task



Source: Internet

Visualization of Potsdam dataset

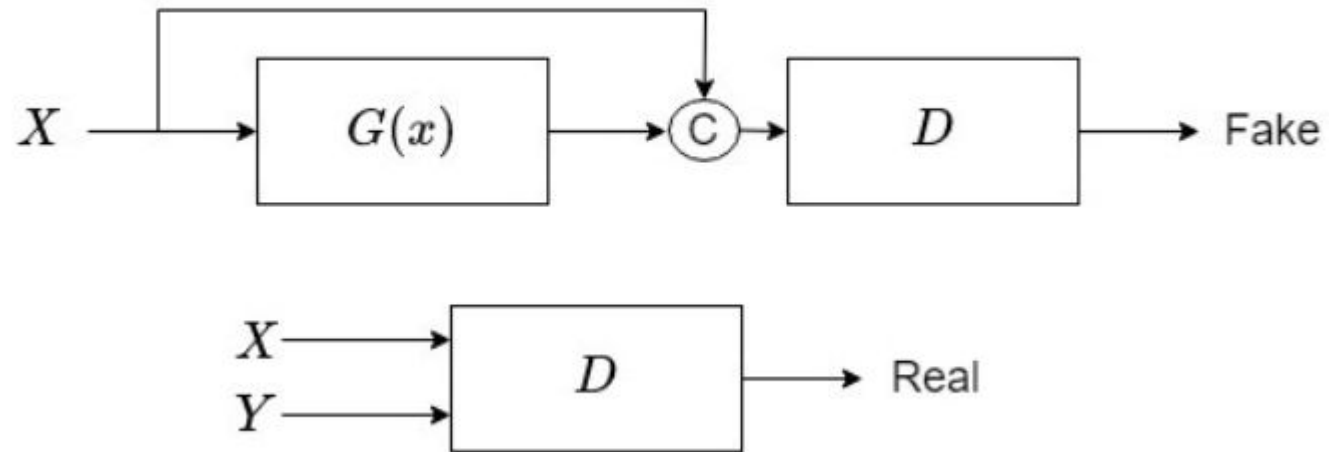
Image Translation



Pix2Pix

Source: Zuo et al. 2021

Image Translation



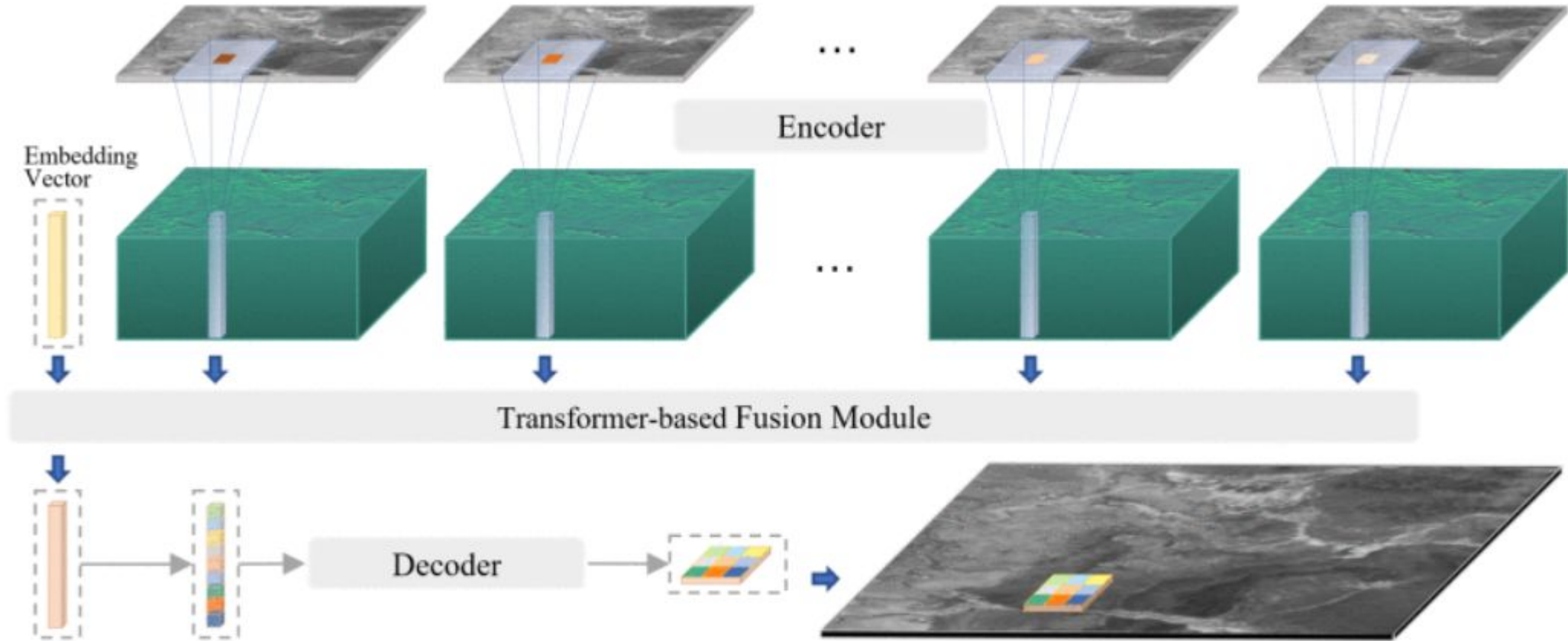
EDCGAN

Image Translation



Super Resolution

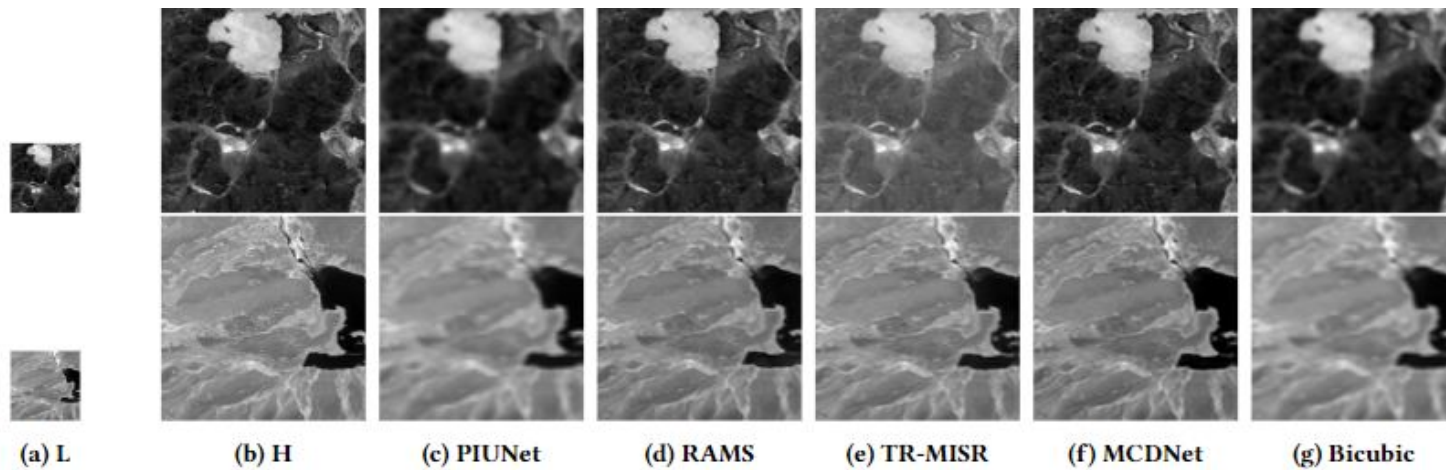
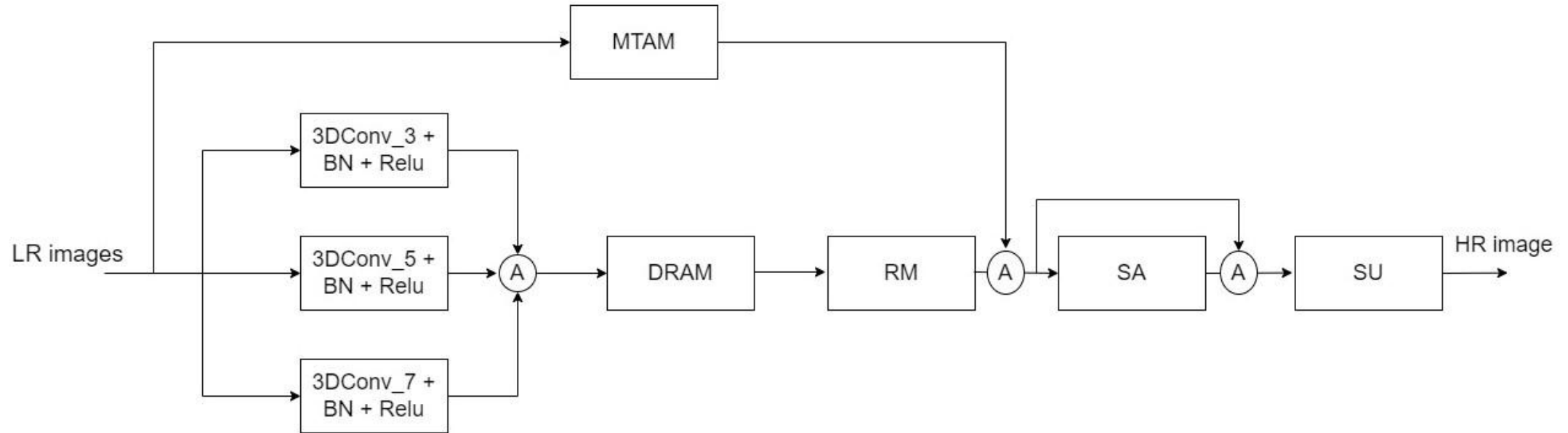
Image Translation



TR-MISR

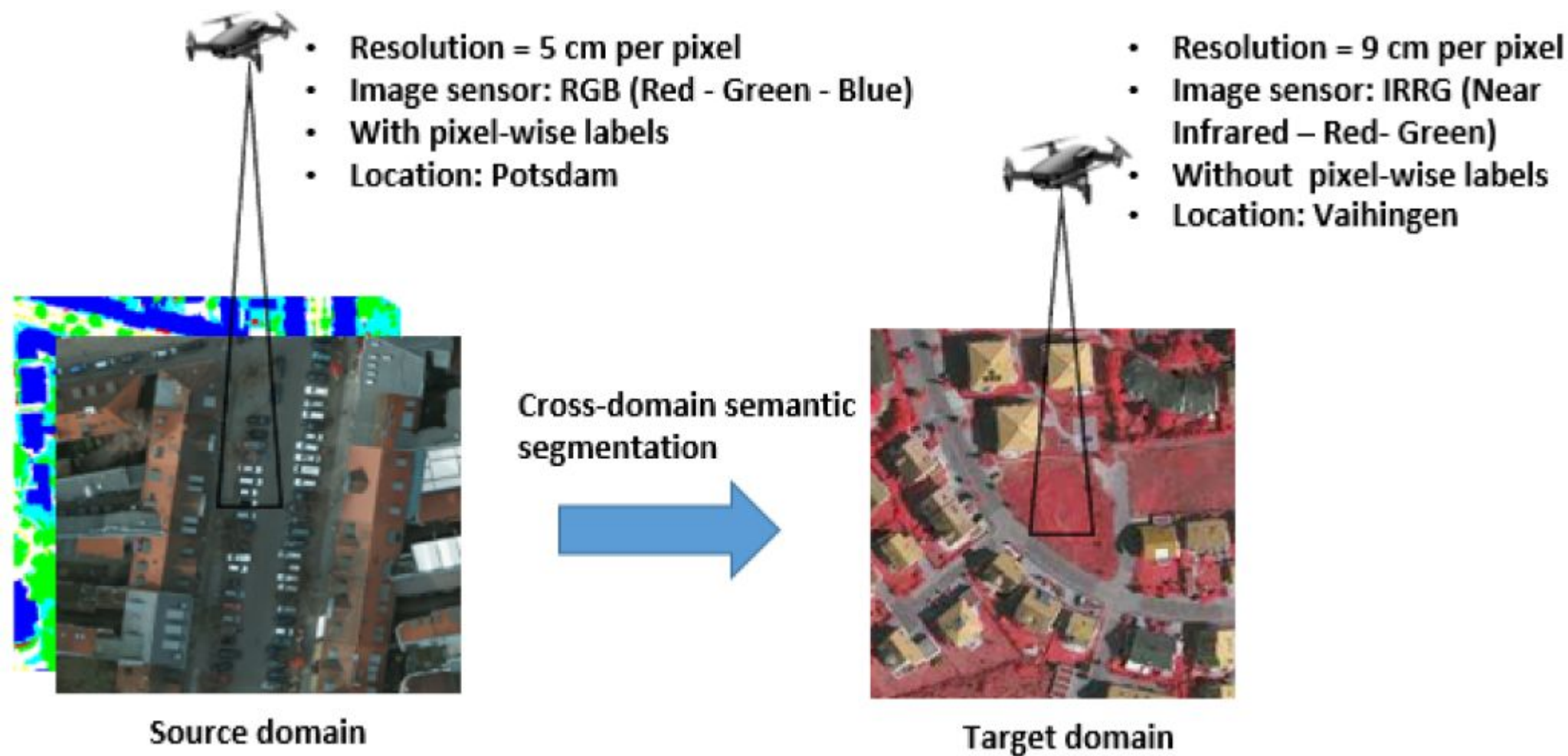
Source: An et al. 2022

Image Translation



Source: Chouhan et al. 2023

Domain Adaptation



Visualization of DA

Domain Adaptation

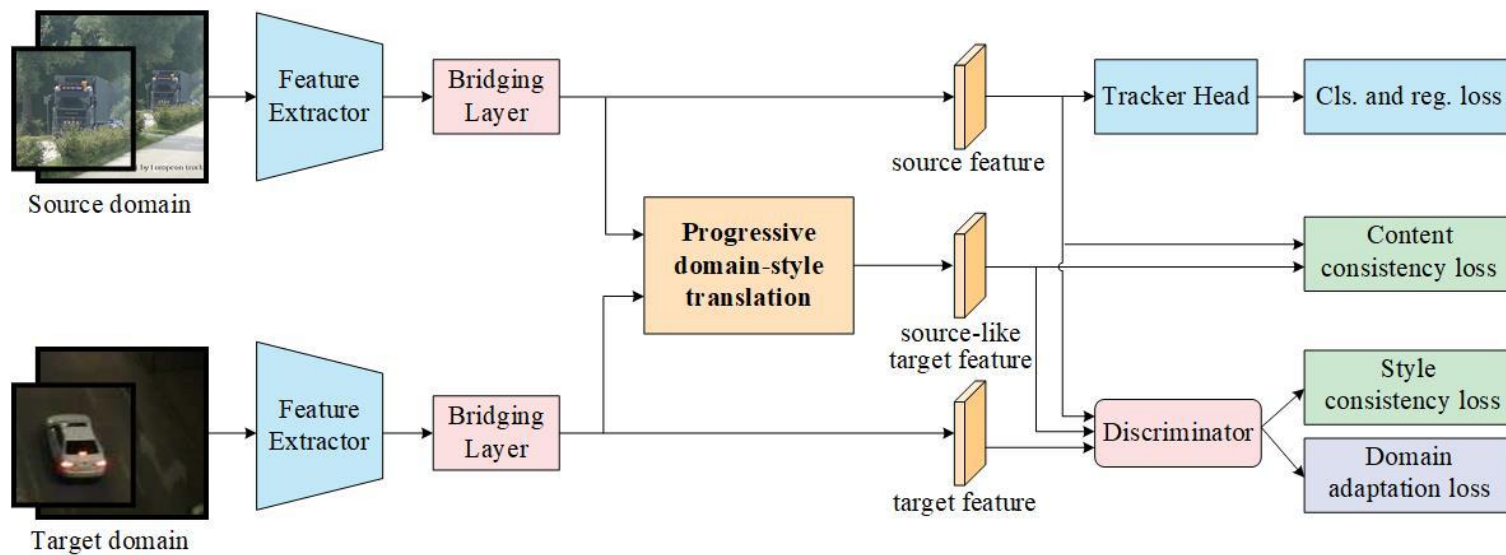
Source: Daytime



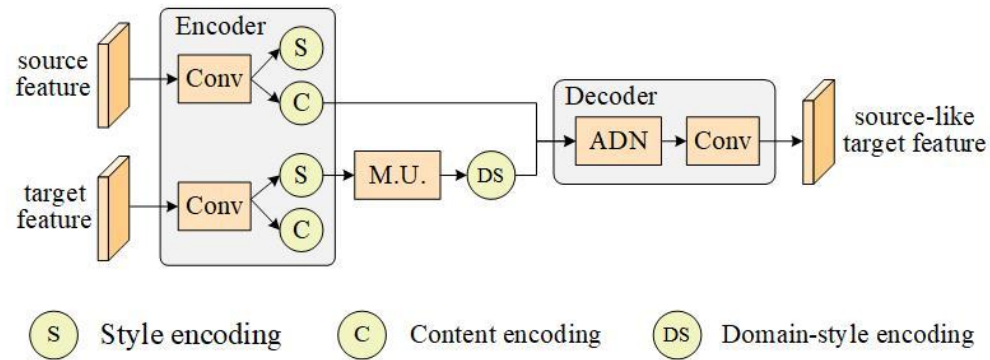
Target: Night-time



Domain Adaptation

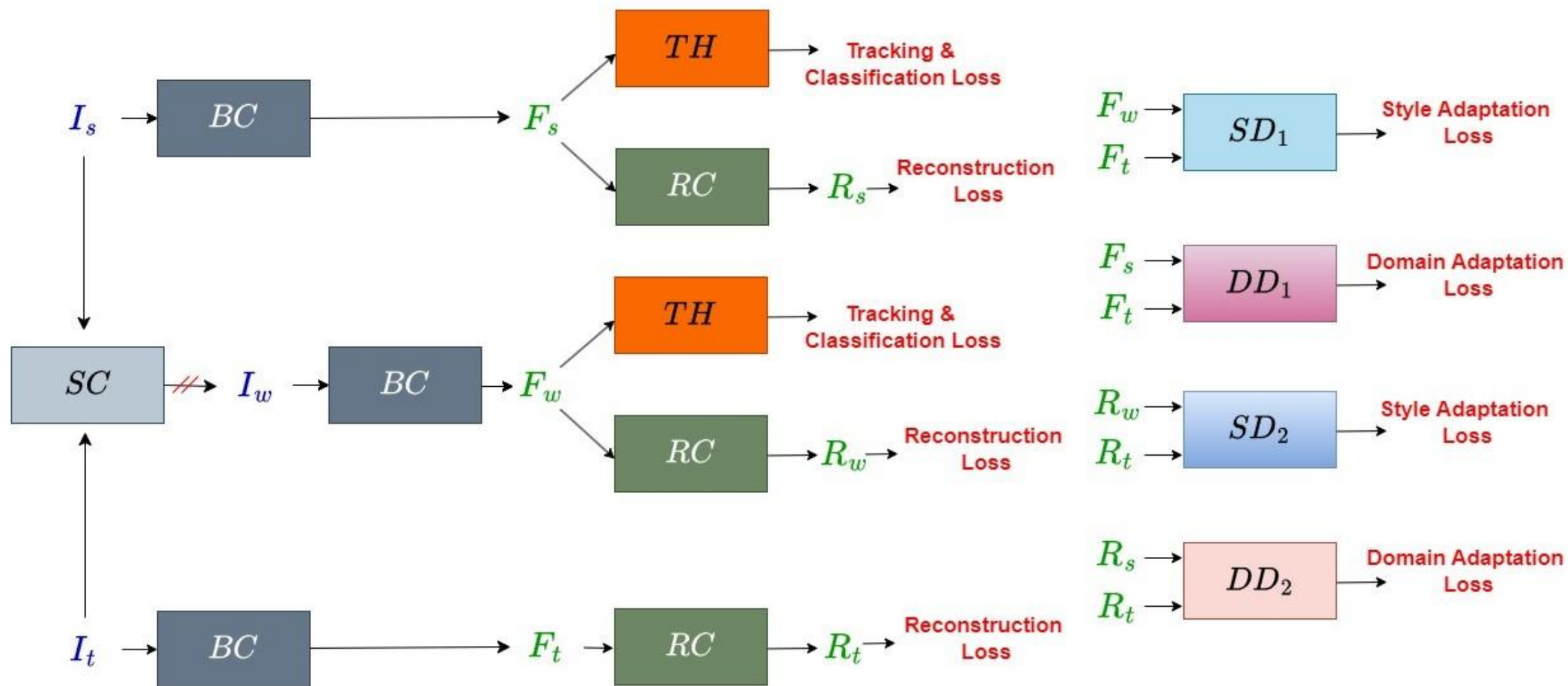


Progressive domain-style translation



PSTL

Domain Adaptation



Source: Chouhan et al. 2024

RADA

Domain Adaptation



(a) *GOT image*



(b) *NAT2021 image*



(c) *Output styled image*

Source: Chouhan et al. 2024

Domain Adaptation



Source: Chouhan et al. 2024

Thank You