DamageCAT

A categorical typology-based building damage classification framework using satellite imagery and deep learning. This repository contains the implementation of the DamageCAT framework for building damage assessment from satellite imagery.

Overview

DamageCAT is a deep learning framework for building damage assessment that:

- Classifies building damage into multiple categories
- Uses pre- and post-disaster satellite imagery
- Implements a transformer-based architecture for accurate damage assessment

Requirements

- Python 3.11
- PyTorch
- torchvision
- numpy
- opencv-python (cv2)
- Pillow (PIL)
- scikit-learn
- matplotlib
- einops
- tifffile

You can install the required packages using:

```
pip install torch torchvision numpy opencv-python Pillow scikit-learn
matplotlib einops tifffile
```

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Data Preparation

The data should be organized in the following structure:

```
data/damagecat/
├── train/
│ ├── images/
│ │ ├── pre_0.png
│ │ └── pre_1.png
│ │ └── pre_2.png
│ │ └── pre_3.png
│ │ └── ...
│ └── masks/
```

```
│ │ ├── pre_0.png
│ │ └── pre_1.png
│ │ └── pre_2.png
│ │ └── pre_3.png
│ │ └── ...
└── test/
├── images/
│ ├── pre_0.png
│ └── pre_1.png
│ └── pre_2.png
│ └── pre_3.png
│ └── ...
└── masks/
│ ├── pre_0.png
│ └── pre_1.png
│ └── pre_2.png
│ └── pre_3.png
│ └── ...
```

Usage

Training

To train the model, use the script in `scripts/run_cd.sh`:

```
bash scripts/run_cd.sh
```

Key parameters in the training script:

- `img_size`: Image size (default: 512)
- `batch_size`: Batch size (default: 8)
- `max_epochs`: Maximum training epochs (default: 200)
- `lr`: Learning rate (default: 0.001)
- `n_class`: Number of damage classes (default: 5)
- `net_G`: Network architecture (default: newUNetTrans)

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Evaluation

To evaluate the model and make predictions, use the script in `scripts/eval.sh`:

```
bash scripts/eval.sh
```

Model Architecture

The framework uses a transformer-based architecture (newUNetTrans) that combines:

- U-Net backbone
- Transformer encoder-decoder
- Multi-scale feature fusion

Pre-trained Models

[Link to pre-trained models will be added]

Citation

If you use this code in your research, please cite our paper:

```
@misc{xiao2025damagecatdeeplearningtransformer,
      title={DamageCAT: A Deep Learning Transformer Framework for
Typology-Based Post-Disaster Building Damage Categorization},
      author={Yiming Xiao and Ali Mostafavi},
      year={2025},
      eprint={2504.11637},
      archivePrefix={arXiv},
      primaryClass={cs.CV},
      url={https://arxiv.org/abs/2504.11637},
}
```

License

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Acknowledgements

This work is based on the DAHiTra framework developed by Navjot Kaur. We would like to thank @nka77 for their pioneering work on transformer-based building damage assessment. Our implementation builds upon their codebase and extends it for our specific use case.

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The original DAHiTra paper can be found at:

- Journal: CACAIE
- ArXiv: 2208.02205