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 -r requirements.txt
```

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/
    ├── 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)

Evaluation

The pre-trained models are available at: [Pre-trained model](#)

To evaluate the model and make predictions, make sure you have the pre-trained model in the `checkpoints/your_project_name` folder, have the test images in the `data/damagecat/test/` folder, and the use the script in `scripts/eval.sh`:

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

Key parameters in the evaluation script:

- `dataset`: Dataset name (default: DamageCAT)
- `data_name`: Data name (default: x)
- `batch_size`: Batch size (default: 8)

Model Architecture

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

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

BD-TypoSAT

The data set used in this work is available at: BD-TypoSAT

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},
}
```

If you use the BD-TypoSAT data set, please cite the dataset:

```
@misc{xiao_2025_15453772,
  author       = {Xiao, Yiming and Mostafavi, Ali},
  title        = {BD-TypoSAT: Building Damage Typology Satellite
Dataset},
  month        = may,
  year         = 2025,
  publisher    = {Zenodo},
  doi          = {10.5281/zenodo.15453772},
  url          = {https://doi.org/10.5281/zenodo.15453772},
}
```

License

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Acknowledgements

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The original DAHiTra paper can be found at:

- Journal: CACAIE
- ArXiv: 2208.02205