

# **Using U-Net to Segment Buildings from Satellite Images**

**MUSA 650**

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# Introduction

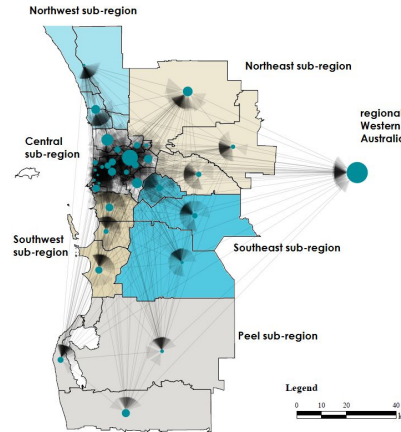
## Use Case

Use CNN UNet to detect the outlines and areas of buildings

In this way to understand the trends of urban development and to advice the real estate investment.



Real Estate Investors



Region Development Strategy



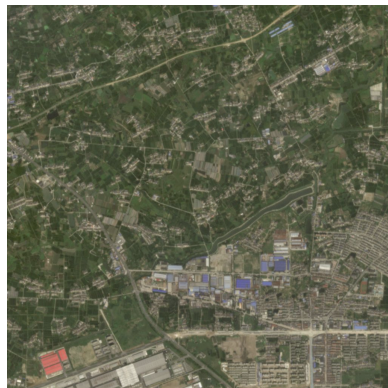
Urban Development

# Data

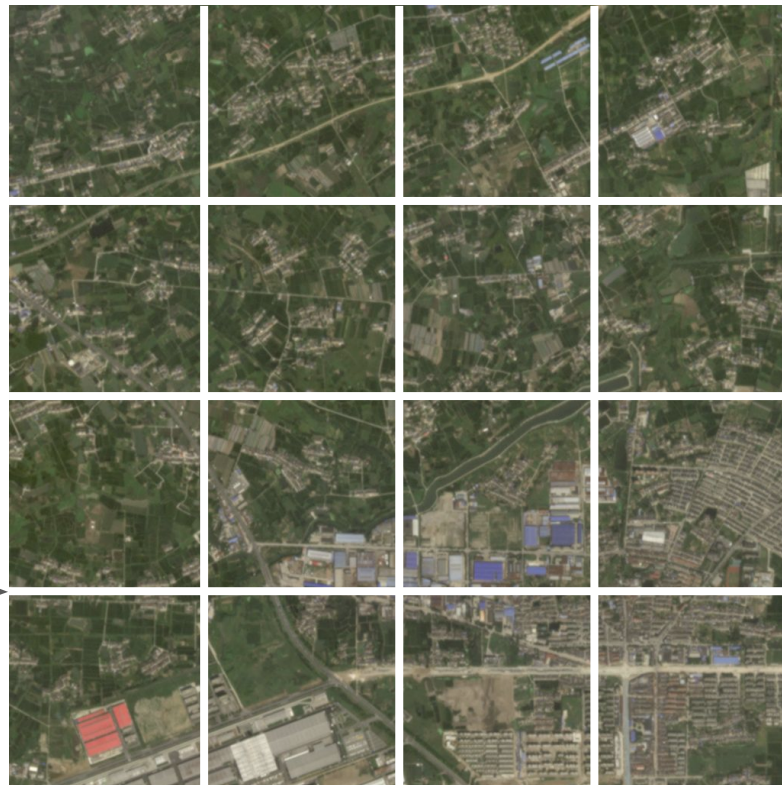


**1408 Images**  
60 Areas  
1024 \* 1024  
RGB

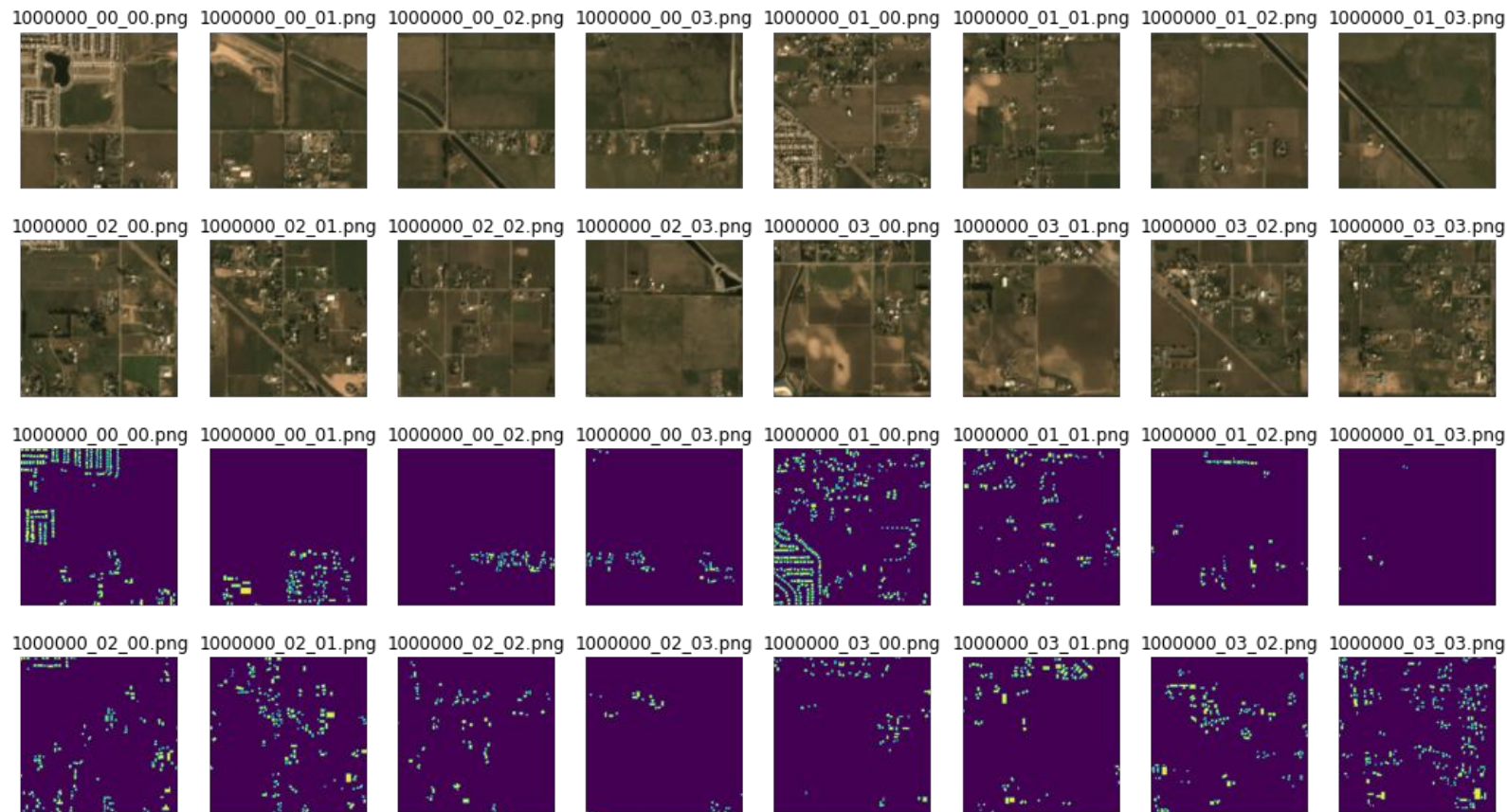
**SN7:**  
Multi-Temporal  
Urban  
Development  
Challenge



Split  
4\*4

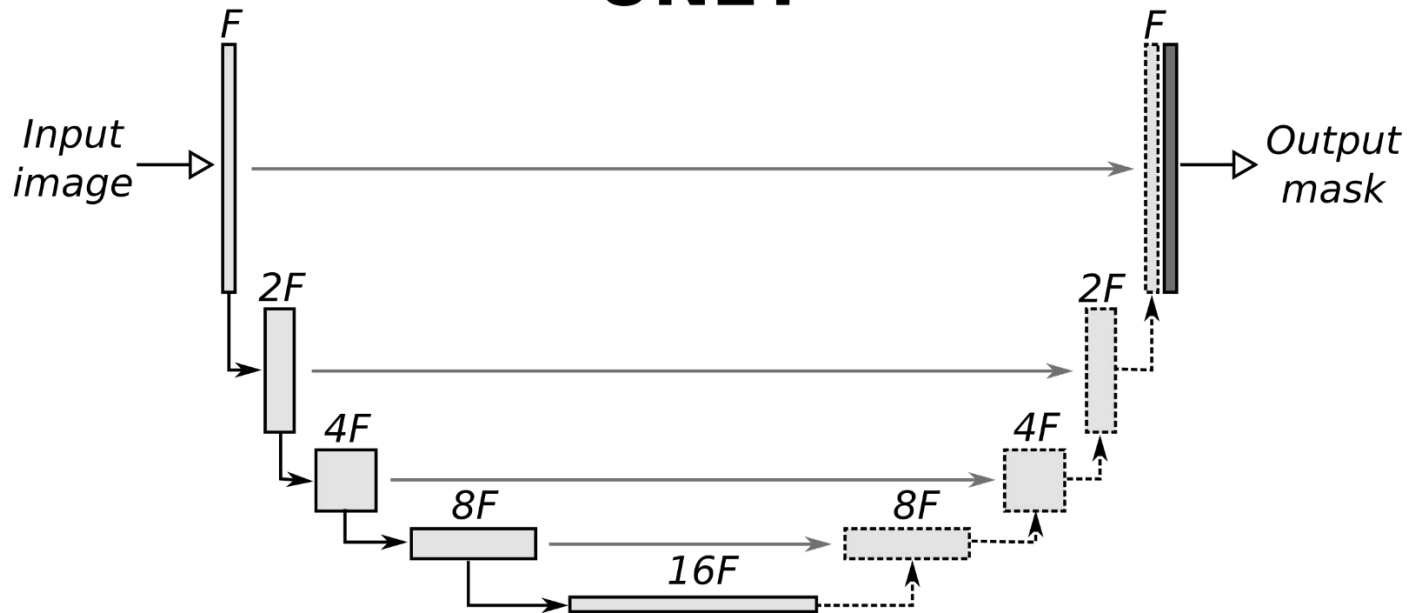
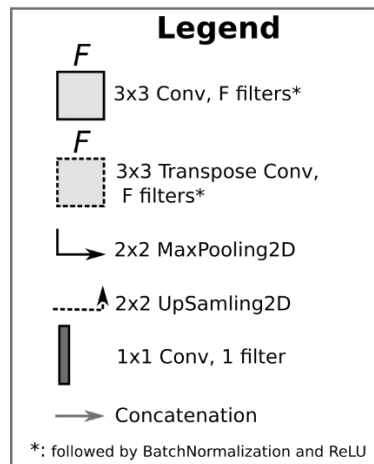


# Sample of Training Set



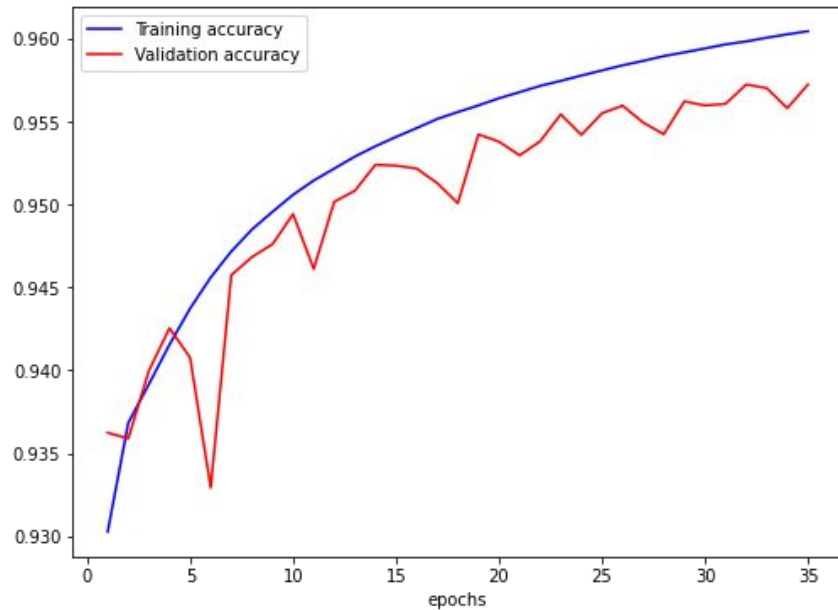
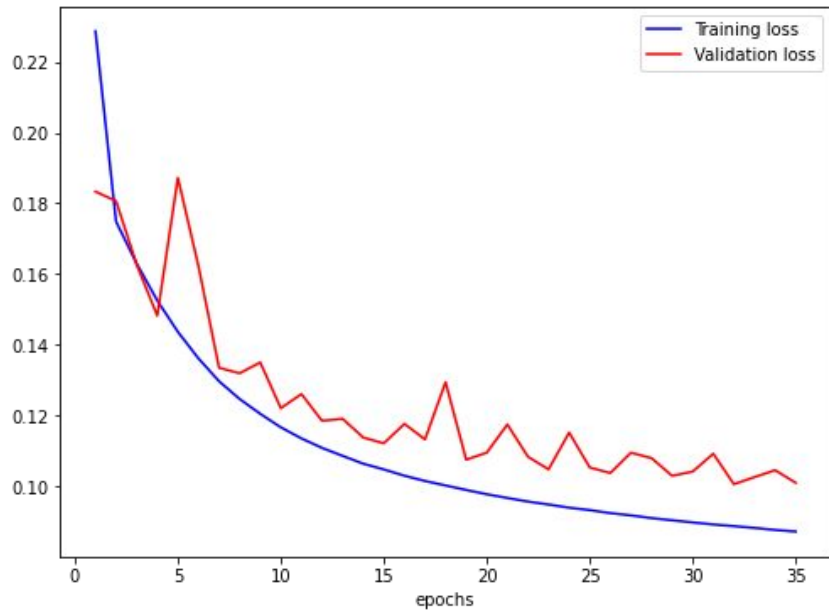
# Methods

## UNET



# Result

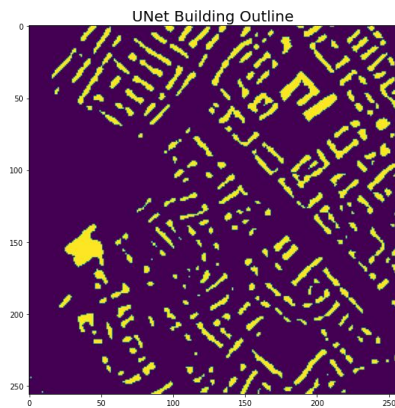
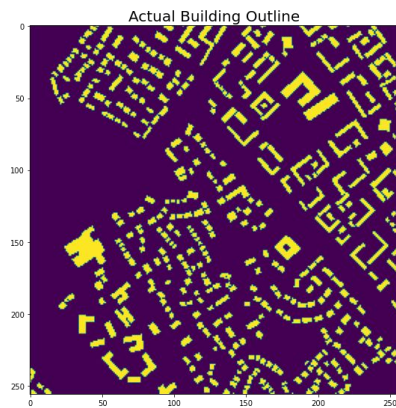
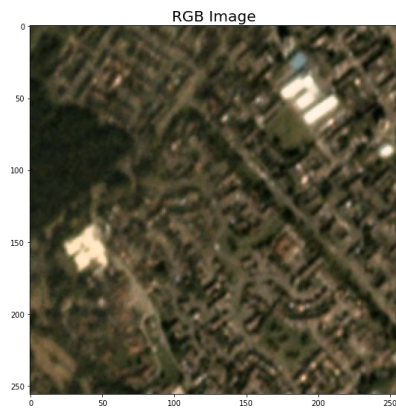
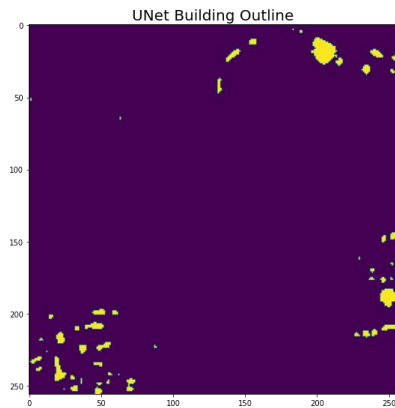
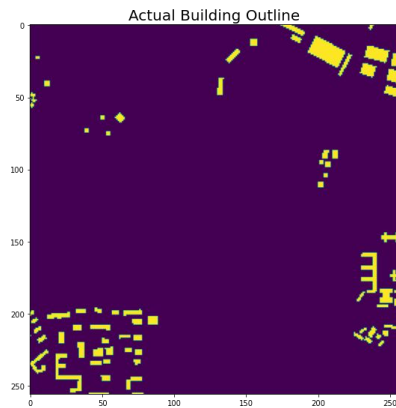
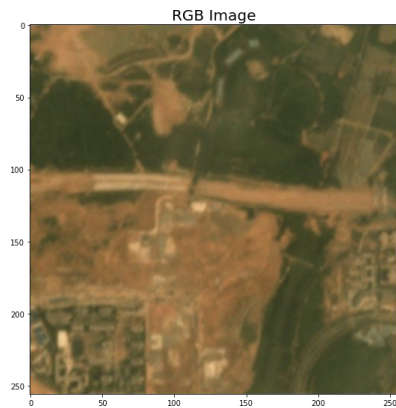
Epochs = 35  
Batch size=10  
Optimizer="rmsprop"  
Loss="sparse\_categorical\_crossentropy"





# Result

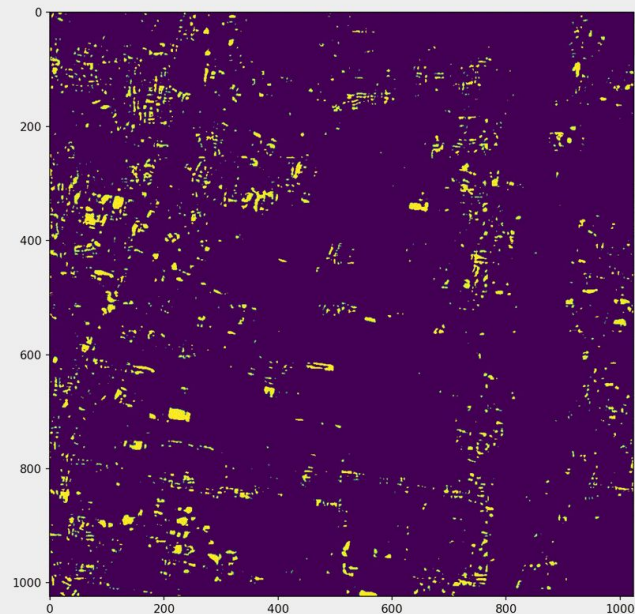
Testing Accuracy: 95.92%



# Application

Asunción, Paraguay  
Jan 2018 - Jan 2021

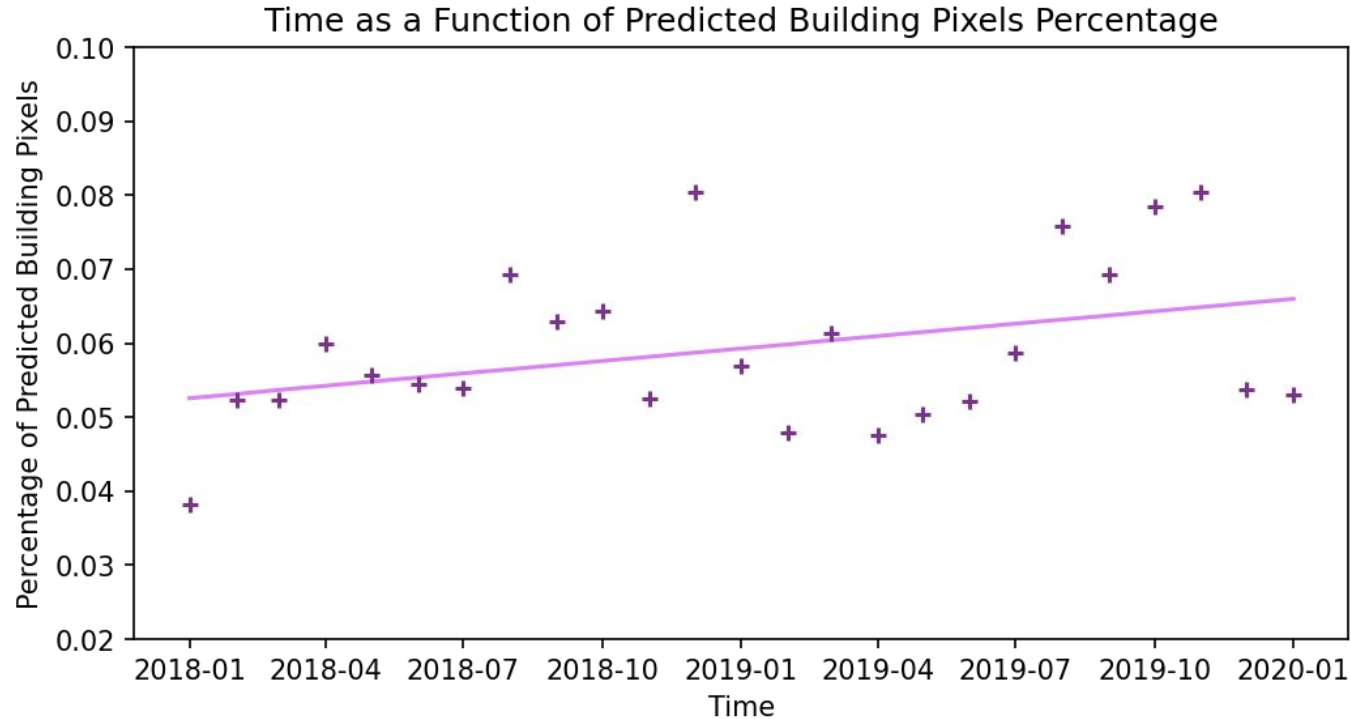
Raw satellite image and UNet prediction in 01/2018, Asunción, Paraguay





# Application

Asunción, Paraguay  
Jan 2018 - Jan 2021



The result shows that in the past 25 months, increased density, broadened built environment boundaries, and less green lands can be observed in Asunción.

## Discussion

In term of the use case, the users (property developers) can now observe urbanization and heated development area by simply inserting satellite images into this model. With the help of this approach, an American developer company can easily understand the development trends even in remote places given corresponding satellite images.

We also tried other U-Net structures, like the model from <https://github.com/zhixuhao/unet>. However, the overwhelming number of parameters makes it the training time so long that it's almost impossible to finish even one epoch. Or an [OOM Error](#) is thrown because of the large tensor shape. So this is one of the reasons why we chose this U-Net structure.

## References

- [U-Net: Convolutional Networks for Biomedical Image Segmentation](#)
- [Why U-Net?](#)
- [Multi-Temporal Urban Development Challenge](#)
- [Spacenet 7 Multi-Temporal Urban Development | Kaggle](#)
- [Image segmentation with a U-Net-like architecture](#)