Convolutional LSTMs for Cloud-Robust Segmentation of Remote Sensing Imagery

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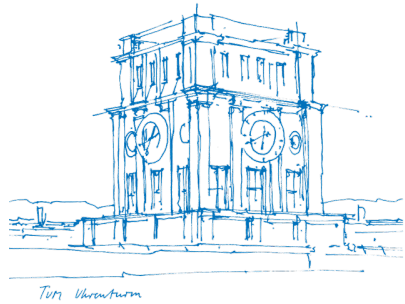
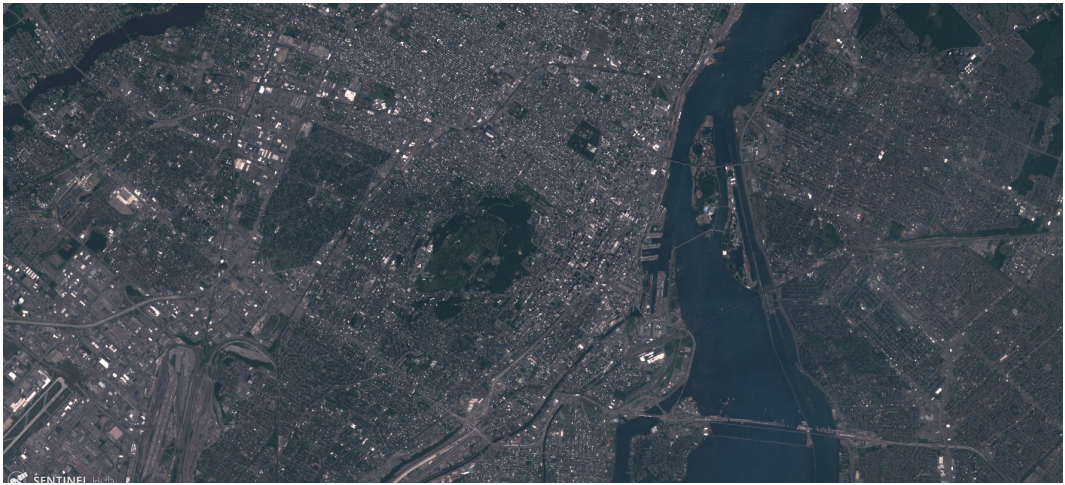
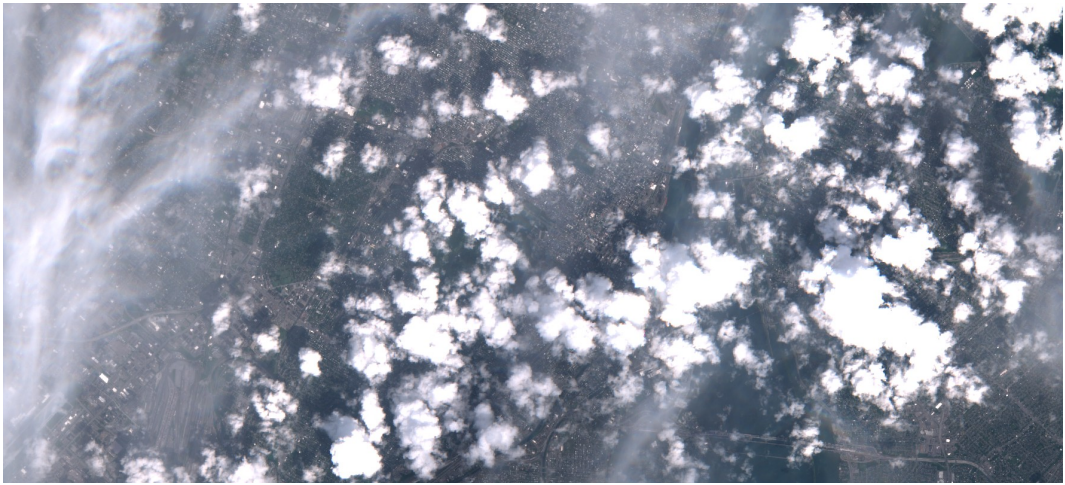


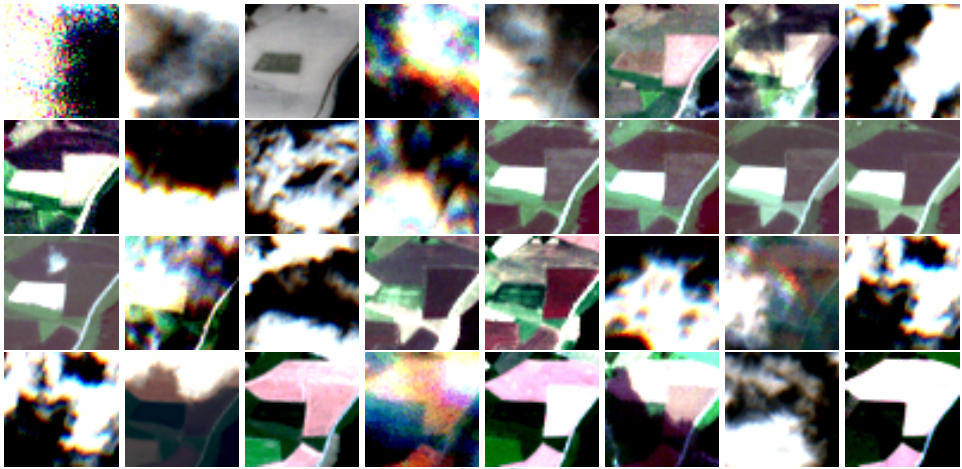
When we think of satellite images we picture this



Cloud coverage is very common



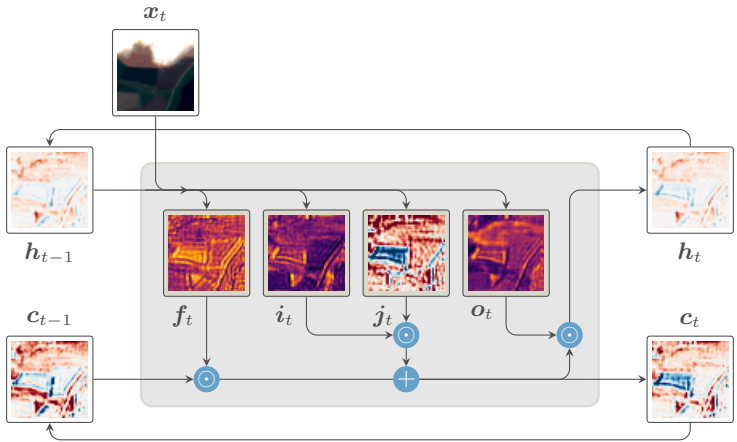
Cloud coverage as spatiotemporal noise



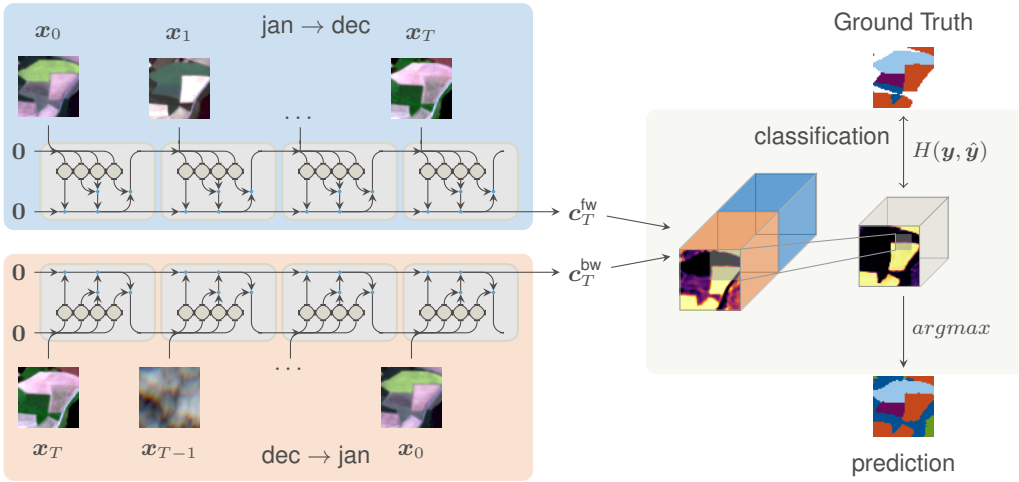
End-to-end trainable model for robust classification

cloudy images $\boldsymbol{x}$ $\xrightarrow{f(\boldsymbol{x})}$ prediction $\boldsymbol{y}$

Extracting features from noisy data with ConvRNNs



Employ ConvRNNs for Vegetation Land Cover Classification directly



It worked very well

Approach	Preprocessing	Accuracy	# Classes
Rußwurm & Körner (2018)	**none**	**90**	17
Rußwurm & Körner (2017)	atmospheric correction	74	**18**
Siachalou et a. (2015)	geometric correction, image registration	**90**	6
Hao et al. (2015)	image reprojection, atmospheric correction	89	6
Conrad et al. (2014)	segmentation, atmospheric correction	86	9
Förster et al. (2012)	phen. normalization, atmospheric correction	73	11
Barragan et al. (2011)	segmentation, atmospheric correction	79	13
Conrad et al. (2010)	segmentation, atmospheric correction	80	6

How did the ConvLSTM handle the clouds?

Experiments

1. **Visualization of hidden states**
   we found specific states dedicated for cloud masking.

2. **Ablation experiment on different cloud coverages**
   similar accuracies on different degrees of cloud coverage.

Takeaways & Poster

1. **ConvRNNs were very robust when considering noisy data**

2. **Would love to hear other's experiences on this**

Publications and Code

Github + DockerHub

`https://github.com/TUM-LMF/MTLCC`
`https://github.com/TUM-LMF/MTLCC-pytorch`

Rußwurm M., Körner M. (2018). ***Multi-Temporal Land Cover Classification with Sequential Recurrent Encoders****. ISPRS International Journal of Geo-Information. https://arxiv.org/abs/1802.02080.*