**Predicting Ground-Level Scene Layout from Aerial Imagery**

Menghua Zhai, Zachary Bessinger, Scott Workman, Nathan Jacobs

http://cs.uky.edu/~ted

---

**Big Picture**

**Key Idea:**
Train a network to predict the semantic layout of a ground-level panorama from an overhead image centered on the camera location.

**Motivations:** This enables several different applications:
- Weakly supervised learning for aerial image classification/segmentation
- Train a network to predict the semantic layout of a ground-level panorama from an overhead image centered on the camera location
- Orientation estimation and fine-grained geocalibration for ground-level images
- Estimating the ground-level appearance of an arbitrary location

---

**Algorithm Overview**

Ground-level Layout as Ground Truth:
Collect the ground layout ground truth using SegNet (Badrinarayanan & Kendall 2015).

Aerial-to-Ground Layout Prediction:
1. Extract hypercolumns (Barsali & Chen 2016) to predict aerial layout
2. Estimate the transformation matrix using the aerial image
3. Transform the aerial layout to the ground layout using the transformation matrix

---

**Experiments**

Weakly Supervised Learning for Aerial Image Classification and Segmentation:
The resulting network learns to extract semantic features from an aerial-level image, all without any manual annotated aerial imagery.

Network Pre-training for Aerial Image Segmentation:
Our proposed technique can be used as a pre-training strategy for semantic-pixel labeling of the aerial-level imagery.

---

**Conclusion**

- **Main innovations:**
  - A novel strategy to relate aerial-level imagery and the ground-level imagery
  - A novel strategy to exploit the automatically labeled ground images as a form of weak supervision for aerial imagery understanding
  - Show the potential of our method in geocalibration and ground appearance synthesis using algorithm

**Acknowledgement:** We gratefully acknowledge the support of NSF CAREER grant (IIS-1553116), a Google Faculty Research Award, and an AWS Research Education grant.