

# **Semi-supervised Regression with Generative Adversarial Networks using Minimal Labeled Data**

## **- Critical Issues, Network Behaviors, and Applications**



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Mentor: Zhigang Zhu

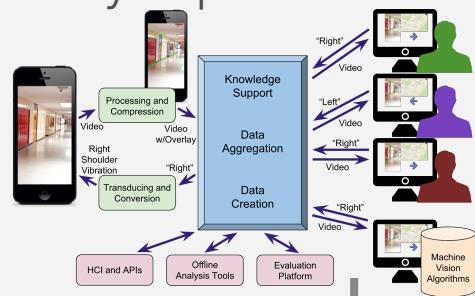
Committee: Jie Gong, Ioannis Stamos, Hao Tang, Jie Wei

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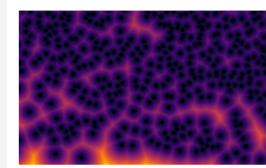
## Single image indoor reconstruction (Professor Stamos)



## Crowd sourced navigation for the visually impaired

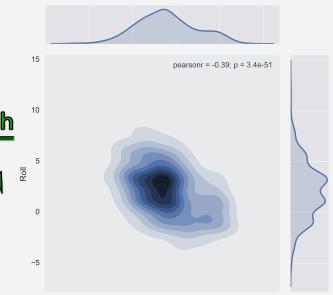
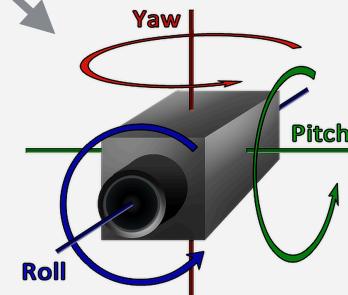


## Dense crowd counting (Professor Tang, Professor Gong)

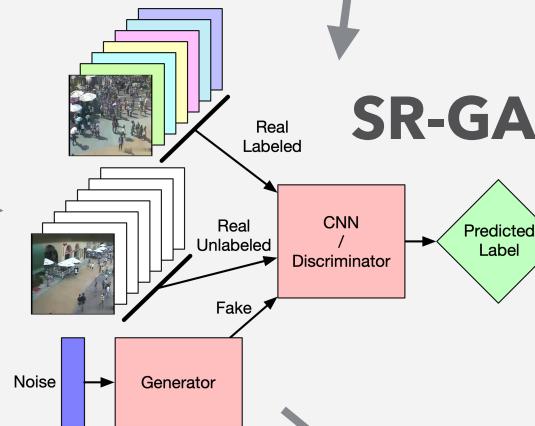


Label topology

## Single image pose estimation (Professor Wei)



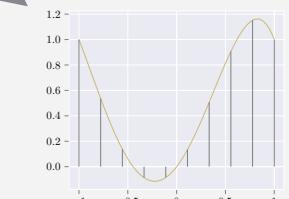
## SR-GAN



Driving prediction



Age estimation



GAN training  
analysis

# Primary Contributions

- A new algorithm, Semi-supervised Regression Generative Adversarial Network (**SR-GAN**), which allows semi-supervised GANs to be applied to regression problems.
- A set of optimization rules which allows for stable, consistent training when using the SR-GAN, including experiments demonstrating the importance of these rules.
- Systematic experiments using the SR-GAN on three real world applications—age estimation, driving steering angle prediction, and dense crowd counting.
- Improved label topology and upsampling to improve multi-target regression labels.

# Publications (1/2)

- [1] Greg Olmschenk, Zhigang Zhu, and Hao Tang. “Generalizing semi-supervised generative adversarial networks to regression using feature contrasting”. In: *Computer Vision and Image Understanding* (2019).
- [2] Greg Olmschenk, Zhigang Zhu, and Hao Tang. “Improving Dense Crowd Counting Convolutional Neural Networks using Inverse k-Nearest Neighbor Maps and Multiscale Upsampling”. In: *(Conference unlisted for blinding)*. 2019, Submitted.
- [3] Greg Olmschenk, Jin Chen, Hao Tang, and Zhigang Zhu. “Dense Crowd Counting Convolutional Neural Networks with Minimal Data using Semi-Supervised Dual-Goal Generative Adversarial Networks”. In: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*. 2019.
- [4] Greg Olmschenk, Hao Tang, and Zhigang Zhu. “Crowd Counting With Minimal Data Using Generative Adversarial Networks For Multiple Target Regression”. In: *Applications of Computer Vision (WACV), 2018 IEEE Winter Conference on*. IEEE. 2018, pp. 1151–1159.
- [5] Jonas Weiss, Gregory Olmschenk, Qiuwen Lou, Folkert Horst, and Bert Jan Offrein. “Simulation Framework and Hardware-in-the-Loop Validation for Analog Compute Accelerators”. In: *Proceedings of the Conference in Cognitive Computing*. 2018.
- [6] Vishnu Nair, Manjekar Budhai, Greg Olmschenk, William H Seiple, and Zhigang Zhu. “ASSIST: personalized indoor navigation via multimodal sensors and high-level semantic information”. In: *Proceedings of the European Conference on Computer Vision (ECCV)*. 2018.
- [7] Vishnu Nair, Christina Tsangouri, Bowen Xiao, Greg Olmschenk, WH Seiple, and Z Zhu. “A Hybrid Indoor Positioning System for Blind and Visually Impaired Using Bluetooth and Google Tango”. In: *Journal on technology and persons with disabilities* 6 (2018).

# Publications (2/2)

- [8] Greg Olmschenk, Hao Tang, and Zhigang Zhu. "Pitch and Roll Camera Orientation from a Single 2D Image Using Convolutional Neural Networks". In: *Computer and Robot Vision (CRV), 2017 14th Conference on*. IEEE. 2017, pp. 261–268.
- [9] Jie Gong, Cecilia Feeley, Hao Tang, Greg Olmschenk, Vishnu Nair, Zixiang Zhou, Yi Yu, Ken Yamamoto, and Zhigang Zhu. "Building smart and accessible transportation hubs with internet of things, big data analytics, and affective computing". In: *International Conference on Sustainable Infrastructure 2017*. 2017, pp. 126–138.
- [10] J Gong, C Feeley, H Tang, G Olmschenk, V Nair, Z Zhou, Y Yu, K Yamamoto, and Z Zhu. "Building smart transportation hubs with internet of things to improve services to people with special needs". In: *Transportation Research Board (TRB) 96th Annual Meeting* (2017).
- [11] Greg Olmschenk, Christopher Yang, Zhigang Zhu, Hanghang Tong, and William H Seiple. "Mobile crowd assisted navigation for the visually impaired". In: *2015 IEEE 12th Intl Conf on Ubiquitous Intelligence and Computing and 2015 IEEE 12th Intl Conf on Autonomic and Trusted Computing and 2015 IEEE 15th Intl Conf on Scalable Computing and Communications and Its Associated Workshops (UIC-ATC-ScalCom)*. IEEE. 2015, pp. 324–327.
- [12] Wai L Khoo, Greg Olmschenk, Zhigang Zhu, and Tony Ro. "Evaluating crowd sourced navigation for the visually impaired in a virtual environment". In: *Mobile Services (MS), 2015 IEEE International Conference on*. IEEE. 2015, pp. 431–437.
- [13] Greg Olmschenk and Zhigang Zhu. "Mobile real-time single image 3D corridor reconstruction using J-Linkage". In: *Machine Vision Applications (MVA), 2015 14th IAPR International Conference on*. IEEE. 2015, pp. 94–97.
- [14] Greg Olmschenk and Zhigang Zhu. "3D Hallway Modeling Using a Single Image". In: *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*. 2014, pp. 158–164.
- [15] Karl Isensee, Greg Olmschenk, Lawrence Rudnick, Tracey DeLaney, Jeonghee Rho, JD Smith, William T Reach, Takashi Kozasa, and Haley Gomez. "Nucleosynthetic Layers in the Shocked Ejecta of Cassiopeia A". In: *The Astrophysical Journal* 757.2 (2012), p. 126.