# Optimization of Point Clouds' RGB and Thermal Information Data Fusion for Buildings' 3D Thermal Mapping

**Yu Hou, Ph.D.,[1] Siyuan Yao,[2] Leslie Ramos,[3] Wenyun Lu,[4] Rebekka Volk., Ph.D., [5] and Lucio Soibelman, Ph.D.[6]**

[1]Ph.D. candidate, Sonny Astani Dept. of Civil and Environmental Engineering, Univ. of Southern California, Los Angeles, CA 90089-1453, USA. E-mail: yuhou@usc.edu
[2]Ph.D. student, Daniel J. Epstein Dept. of Industrial and Systems Engineering, Univ. of Southern California, Los Angeles, CA 90089-1453, USA. E-mail: siyuanya@usc.edu
[3]Undergraduate student, Sonny Astani Dept. of Civil and Environmental Engineering, Univ. of Southern California, Los Angeles, CA 90089-1453, USA. E-mail: lgramos@usc.edu
[4]Master student, Sonny Astani Dept. of Civil and Environmental Engineering, Univ. of Southern California, Los Angeles, CA 90089-1453, USA. E-mail: wenyunlu@usc.edu
[5]Institute for Industrial Production, Karlsruhe Institute of Technology, Karlsruhe, Baden-Wuerttemberg, Germany. E-mail: rebekka.volk@kit.edu
[6]Sonny Astani Dept. of Civil and Environmental Engineering, Univ. of Southern California, Los Angeles, CA 90089-1453, USA. E-mail: soibelman@usc.edu

## ABSTRACT

Three-dimensional thermal mapping has been commonly used for building energy performance audits. Many researchers have focused on single building audits and modeling multiple buildings in a large district through aerial images. To solve accuracy and efficiency tradeoffs, researchers have used data fusion methods to project information from thermal images onto a 3D RGB model reconstructed by high-resolution RGB images to generate a 3D thermal model. This approach overcomes issues related to the direct use of thermal images to reconstruct a 3D model that might otherwise fail due to low resolution thermal images. It has been demonstrated that the accuracy of thermal images is influenced by camera shooting angles, the distance between the objects and cameras, and drone flight speed. Researchers have also demonstrated that edge pixels usually introduce more errors than center pixels of a thermal image. These facts emphasize the need for different pixel locations in thermal images to be assigned with distinct importance when generating a 3D thermal model. This paper introduces a novel framework that was developed to support the improved performance of the thermal and RGB data fusion process.