A METHODOLOGICAL ROUTINE FOR **EXTRACTING BUILDING GEOMETRIES** IN LOW LEVEL OF DETAIL USING **AIRBORNE LIDAR** DATA

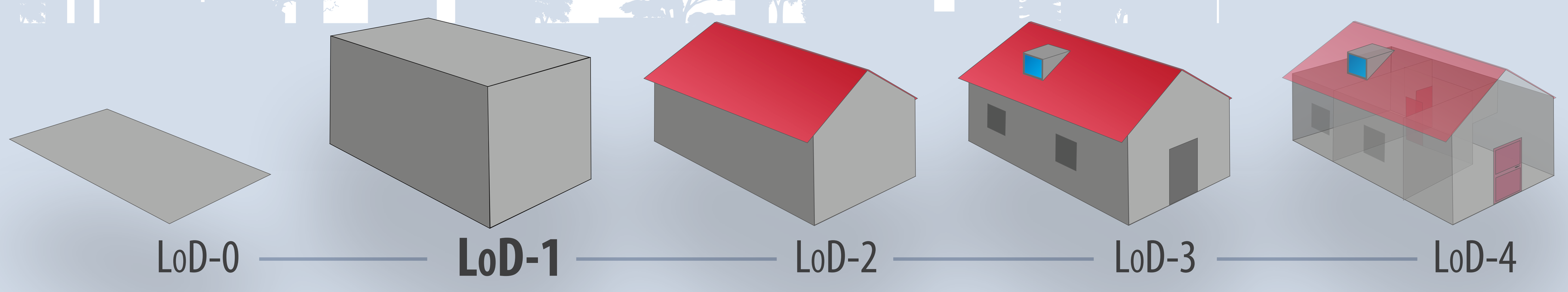
RODOLFO G. **LOTTE**, CLÁUDIA M. DE **ALMEIDA**, AND EDISON A. **MITISHITA**

INTRODUCTION

Urban environments are made by complex structures, mostly with non-linear objects, but also with varity of green areas, different shapes, sizes and compositions. The automation of the mapping process of these structures has become an interest topic in the past decades (HAALA; KADA, 2010), now by the demand to understand its different effects, or by the greater availability of instruments, such as laser scanners (**LiDAR** - *Ligth Detection And Ranging*) and opticals (with advanced techniques in fotogrammetry).

Due to the high geometric accuracy of such data, the laser scanners for topographic purposes have led the research of urban 3D reconstruction to a new perspective of processing, therefore, to the generation of 3D models with a high geometric quality (BLAIS, 2004; ROTTENSTEINER et al., 2005). 3D models of buildings, for instance, when generated on a **large scale**, allow us **to better understand** how their characteristics of **shape**, **volume**, and **space occupation** could impacts our environment (in a positive and negative way).

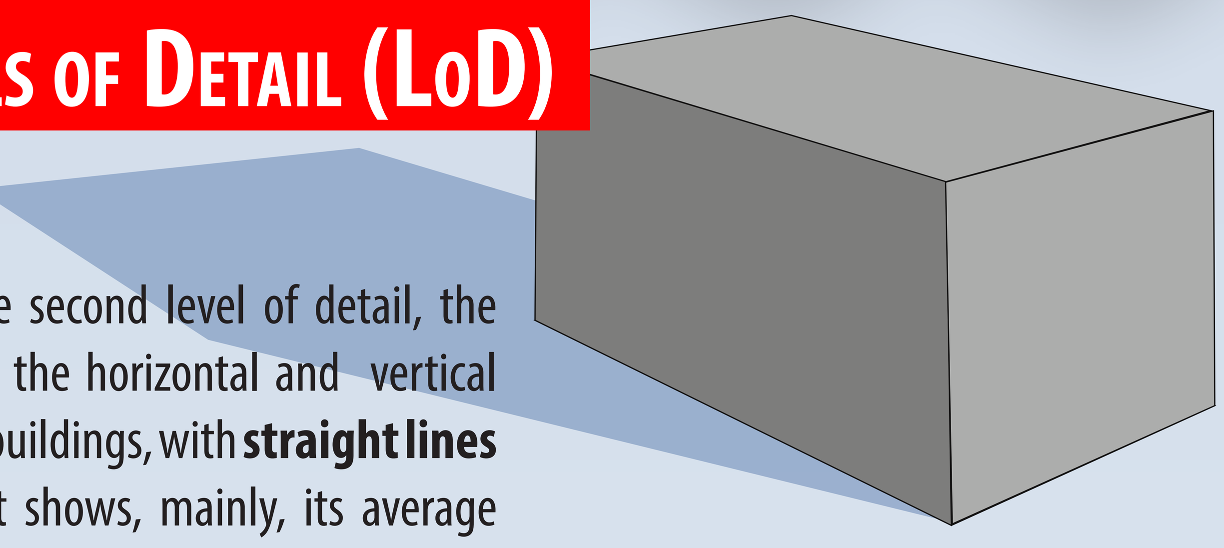
Present a methodology to reconstruct 3D buildings in low level of detail, thus, extract its geometry caracterisctics such as shape, volume, location, area, and topography height



LEVELS OF DETAIL (LoD)

LoD-1

Representing the second level of detail, the LoD-1 corresponds to the horizontal and vertical representation of the buildings, with **straight lines** and **no openings**. It shows, mainly, its average height and spatial location (KOLBE et al., 2005).



RECIFE-PE

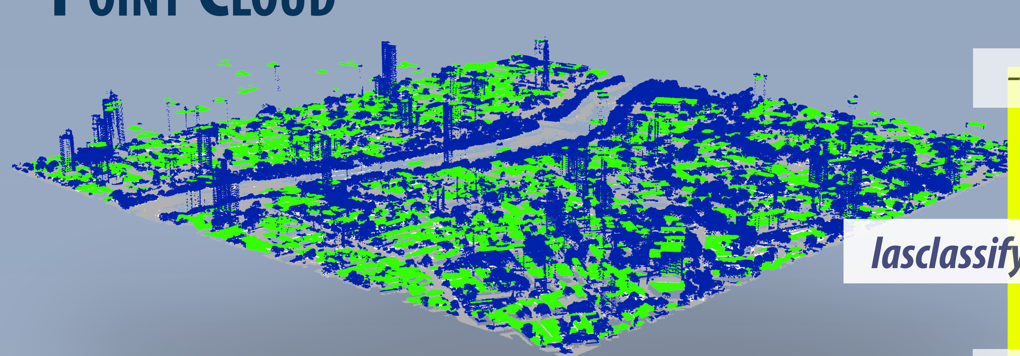
POPULATION: 1.5 MILLION
AREA: 218,400 km^2
DEMOGRAPHIC DENSITY: 7,039.64 hab/km^2
(IBGE, 2010)

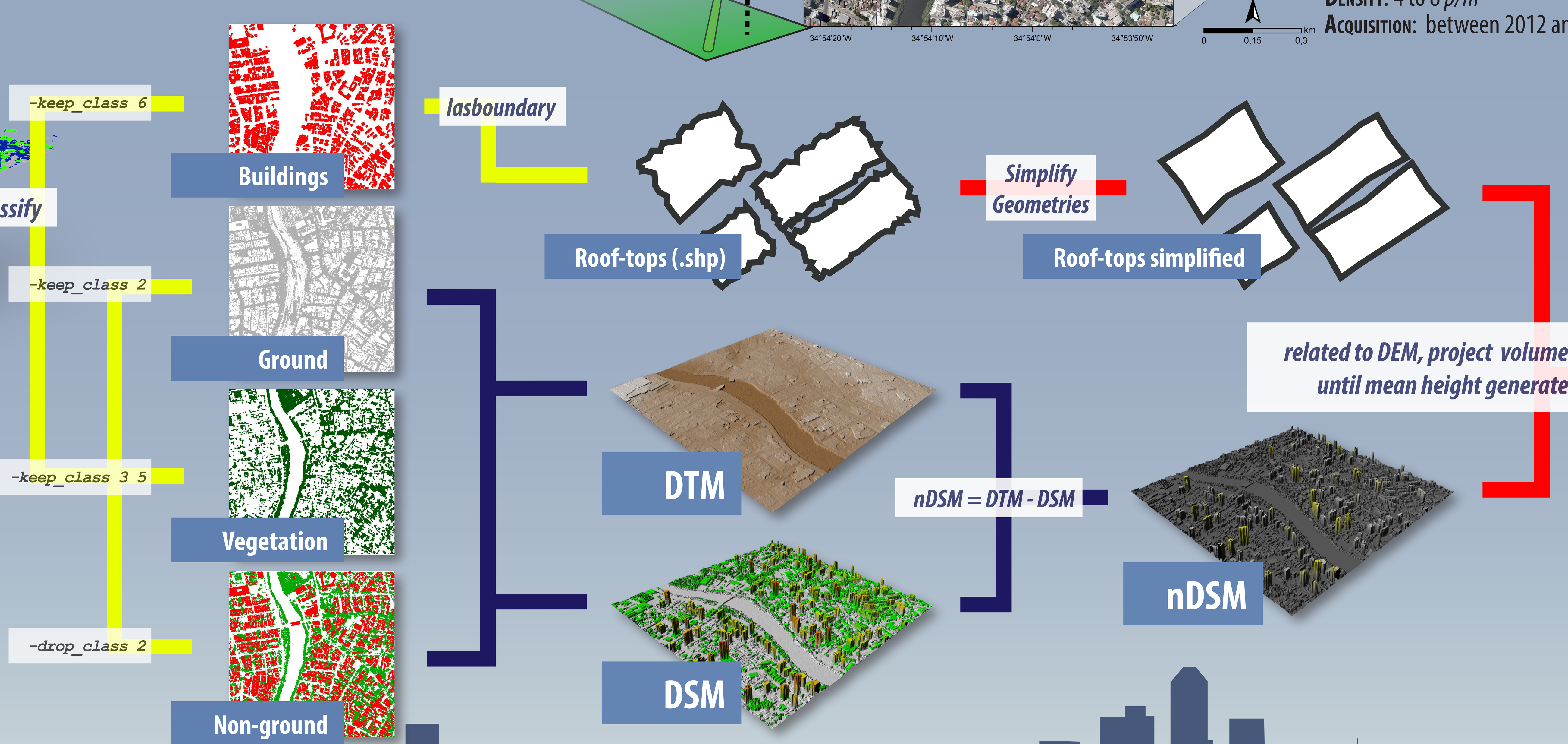
DATA ACQUIREMENT

SENSOR: OPTECH ALTM GEMINI
DENSITY: 4 to 8 p/m^2
ACQUISITION: between 2012 and 2013

METHODOLOGY

POINT CLOUD



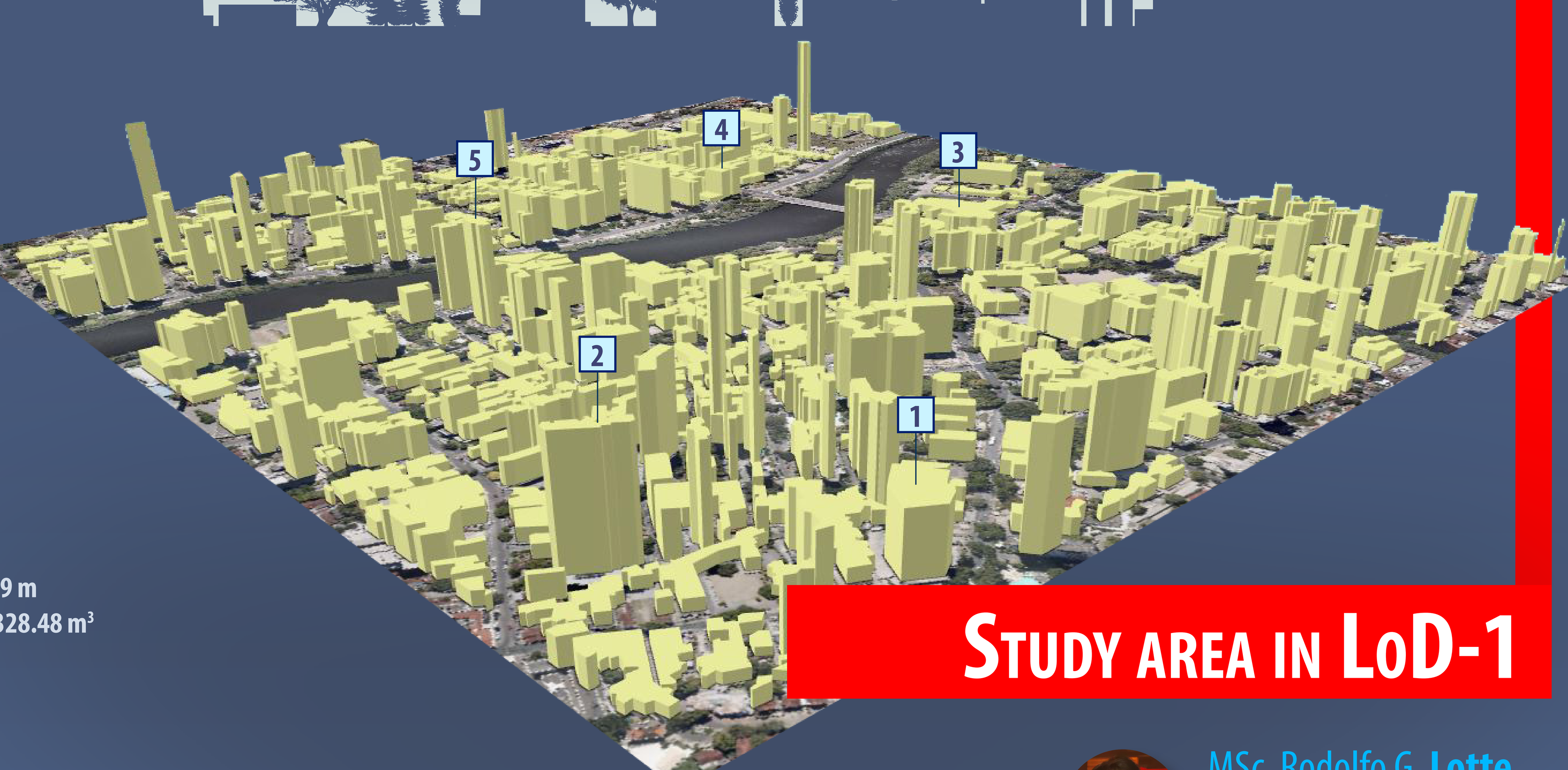


LAStools [1]
Surfer [2]
QGIS + GRASS [3] + Qgis2threejs [4]

1. ***LAStools (rapidlasso GmbH)***. *Open source (LGPL 2.1 license used). Available in https://rapidlasso.com/lastools .*
2. ***GoldenSoftware Surfer.*** *A trial license was used in this work. Available in http://www.goldensoftware.com .*
3. ***QuantumGIS + GRASS*** *plataform. Open source . Available in http://www.qgis.org .*
4. ***Qgis2threejs plugin.*** *A python based plugin for 3D visualization and reconstruction. Open Source. Available in https://plugins.qgis.org/plugins/Qgis2threejs/.*

RESULTS AND CONCLUSIONS

1	2	3	4	5
Area: **1696.69 m²**	Area: **488.23 m²**	Area: **3,452.18 m²**	Area: **634.12 m²**	Area: **368.55 m²**
Average height: **28.01 m**	Average height: **53.77 m**	Average height: **6.68 m**	Average height: **19.45 m**	Average height: **55.09 m**
Approx. volume: **63,240.02 m³**	Approx. volume: **26,763.79 m³**	Approx. volume: **23,029.55 m³**	Approx. volume: **12,533.46 m³**	Approx. volume: **20,328.48 m³**



STUDY AREA IN LoD-1

- Extraction of geometries in **large scale** using LiDAR data
- **Low buildings** with vegetation surrounding its base, tends to present a bad representation of its shape
- **High buildings** tends to be **better** represented by the methodology presented
- **Airborne LiDAR** surveys usually are used to large demand, but it's highly probable it does not provide **more than LoD2**
- Considering the scale, the **geometries parameters** shows are satisfactory, however, it could present even more details

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MSc. Rodolfo G. **Lotte**
PhD student in Remote Sensing
National Institute for Space Research (**INPE**)
lotte@dsr.inpe.br

Dra. Cláudia M. de **Almeida**
Researcher
National Institute for Space Research (**INPE**)
almeida@dsr.inpe.br

Dr. Edson A. **Mitishita**
Professor in the Department of Geodesy
Federal University of Paraná (**UFPR**)
mitishita@ufpr.br

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