SPATIAL DATA MODELING AND MANAGEMENT: UNLOCKING THE POWER OF SPATIAL DATABASES

Annabelle KIEFER[1], Angelica MORENO[1], Nicole SALAZAR-CUELLAR[1]

[1]Department of Geoinformatics – Z_GIS, University of Salzburg, Austria; Copernicus Master in Digital Earth, EMJM co-funded by the European Union

Introduction

Geospatial data is not just about storing locations, it's about unlocking **spatial intelligence**.

This study explores:

1. Operating a Spatial Database System
Dive into PostgreSQL and PostGIS to understand the backbone of spatial data management.

2. Managing & Analyzing Spatial Data
Use advanced spatial operations to manipulate, query, and visualize data directly within the database.

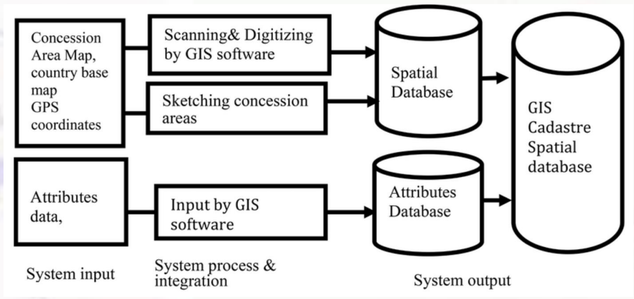
3. The Role of Databases in GI Infrastructure
Discover how spatial databases are integrated into Geographic Information (GI) systems, enabling efficient workflows and data-driven decision-making.

Objectives

1. Explore PostgreSQL & PostGIS for spatial data management.
2. Populate and analyze vector data in spatial databases.
3. Integrate spatial databases with GIS tools like QGIS.
4. Perform spatial queries for data-driven insights.
5. Assess benefits and challenges of spatial databases.

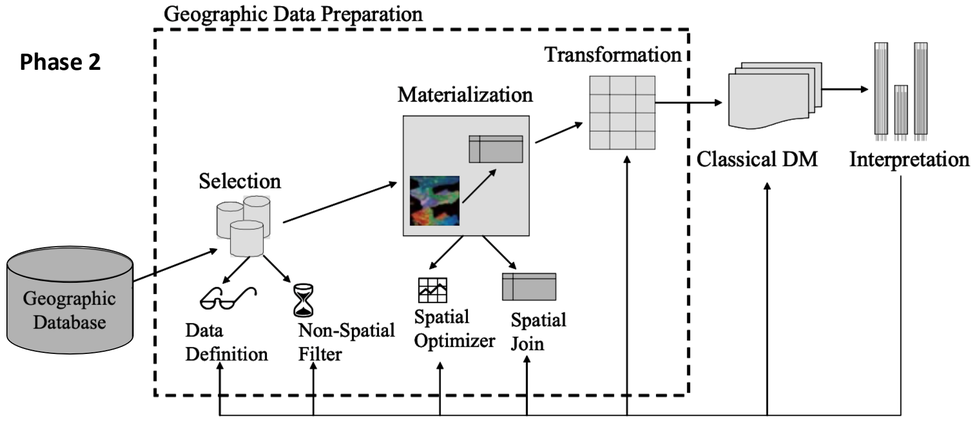
Methodology

Phase 1



Kamara, S. M. (2019). Integration of GIS in the Development of an Environmental Cadastre Administrative System for the Environment Protection Agency Sierra Leone. *Journal of Geographic Information System*, *11*(4), 411-428.

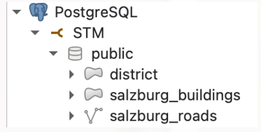
Phase 2



Bogorny, V., Engel, P., & Alvares, L. O. (2005). Spatial data preparation for knowledge discovery. *IEEE Computer Graphics*, *24*(5), 16-19.

Results

Database creation



Data Schema

Id	Name	Alias	Type	Type name	Length	Precision
0	id		Integer (32 bit)	int4	-1	0
1	fclass		Text (string)	varchar	-1	0
2	name		Text (string)	varchar	-1	0
3	type		Text (string)	varchar	-1	0
4	district_id		Integer (32 bit)	int4	-1	0

Key Attributes

```
UPDATE salzburg_roads
SET district_id = district.id
FROM district
WHERE ST_Intersects(salzburg_roads.wkb_geometry, district.wkb_geometry);
```

HIGHWAY DATASET (Child Table 1)

id	fclass	name	maxspeed	bridge	tunnel	district_id
1	motorway	West Autobahn	100	F	F	20
2	r				F	20
3	r					
4	r					
5	r					
6	r					

Foreign Key

BUILDING DATASET (Child Table 2)

id	fclass	name	type	district_id
1	building	*NULL*	apartments	1
2	building	Gummitechni...	commercial	1
3				
4				
5				
6				

Primary Key

st_kz	fl	meridian	id
1	7136872	31	1
1	501635	31	2
1	1575211	31	3
1	6215958	31	4
1	1100915	31	5
1	4823992	31	6

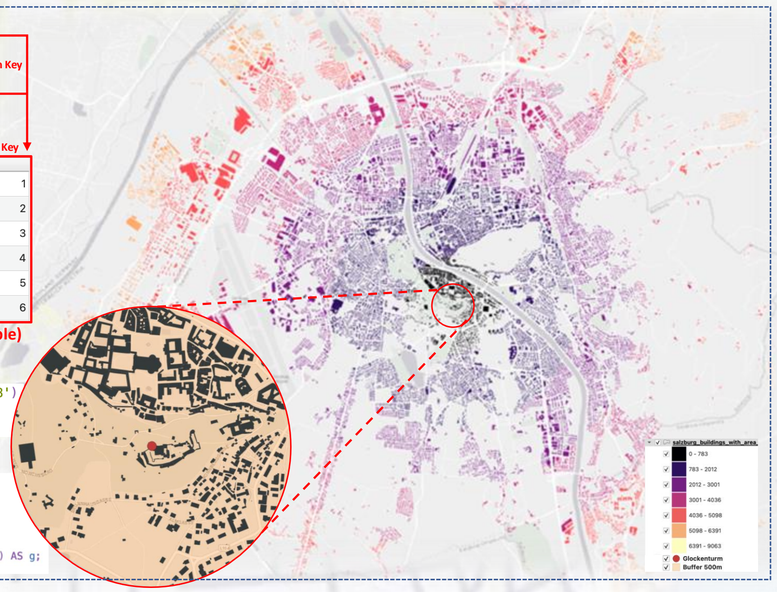
DISTRICT TABLE (Parent Table)

Centroid & Buffer

```
SELECT ST_Buffer(st_centroid(wkb_geometry), 500, 'quad_segs=28')
FROM salzburg_buildings
WHERE name = ('Glockenturm')
```

Area & Distance

```
SELECT
    b.*,
    ST_Area(b.wkb_geometry) AS area,
    ST_Distance(b.wkb_geometry, g.wkb_geometry) AS distance
FROM
    salzburg_buildings AS b,
    (SELECT wkb_geometry FROM salzburg_buildings WHERE name = 'Glockenturm') AS g;
```



Discussion

With the growing importance of **big data**, learning & integrating spatial databases into GI infrastructure has become crucial and indispensable.

Advantages of spatial databases

- Enhances traditional GI workflows.
- Spatial operations directly at the database level.
- Enables **multi-user** access.
- Allows high **data volume** & data velocity.
- Allows **complex data** & analysis.
- Comprehensive & reproducible.
- Consistency across datasets.

Disadvantages of spatial databases

- Investment in human resources.
- Requires technical expertise.
- Possibility of not supported geometry types in vector data.

Conclusions

1. Creating a spatial database using PostgreSQL & PostGIS.
2. Efficiently integrating vector data (points, lines, polygons).
3. Spatial queries like buffering and proximity analysis providing key insights.
4. QGIS visualization enhanced decision-making.
5. A powerful geodatabase for spatial data management and analysis!

Scan the QR code to access the digital version of the poster

Contact:
Nicole Salazar-Cuellar
Copernicus Master in Digital Earth Candidate
darlyng.salazar-cuellar@stud.plus.ac.at

Co-funded by the European Union