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Making domain-specific automotive engineering road space data in OpenDRIVE available for GIS

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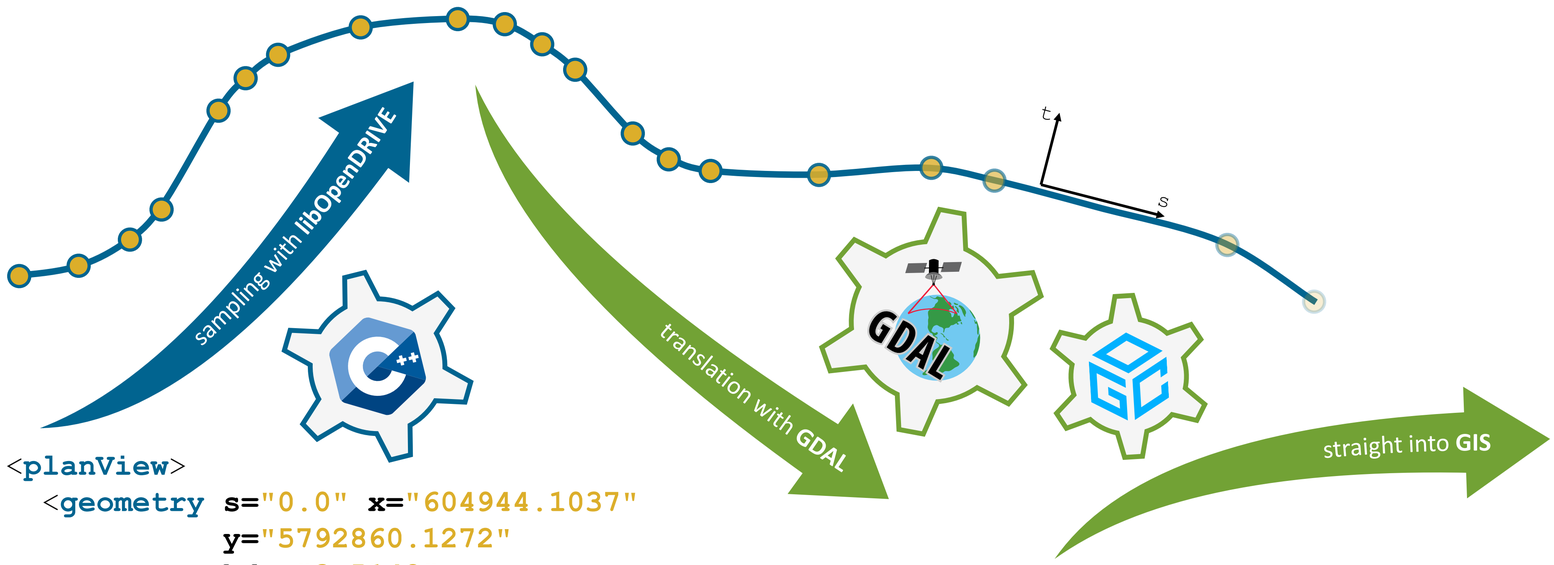

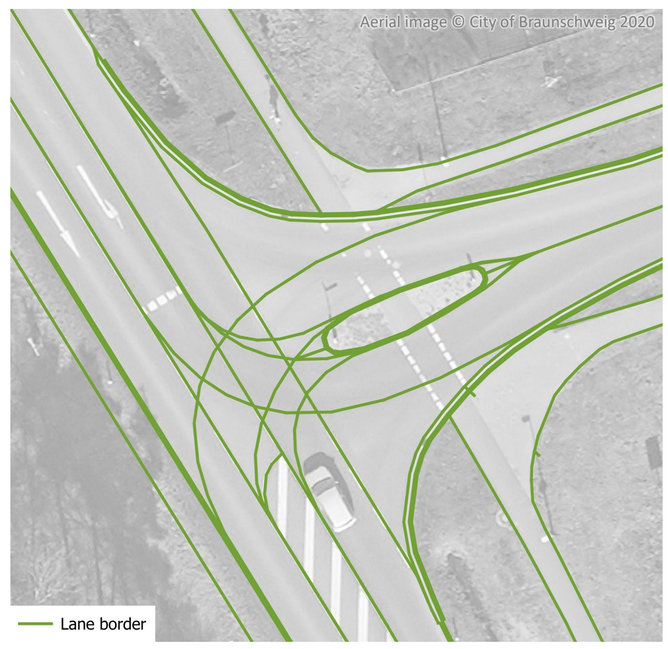

Simple Feature type	OpenDRIVE element
Point	signal
LineString	referenceLine laneBorder
Polygon	lane roadMark roadObject

Problem statement

Governmental institutions and academia show increasing interest in OpenDRIVE road data for mobility simulation, urban planning and infrastructure maintenance.

But, usage of highly detailed road network models (HD maps) is often restricted to the automotive engineering domain where commercial software or custom tools with limited functionality are used for data handling.

The current lack of integration into popular geographic information systems (GIS) significantly limits the interoperability of OpenDRIVE for public application.

Our goal is to bring the domains of automotive engineering and GIS closer together.

Try it out!

dlr-ts.github.io/gdal-opendrive-how-to/

Technical solution

- We extend the open-source Geospatial Data Abstraction Library (GDAL) [1] with a read-only vector driver for OpenDRIVE.
- GDAL uses the OGC Simple Features data model for translation between supported vector formats.
- Using libOpenDRIVE [2], we linearly approximate parametric OpenDRIVE geometries into Simple Features.
- Semantics from traffic-regulating infrastructure (signs and traffic lights) are preserved.

This approach realises direct conversion of OpenDRIVE into common geodata formats such as GeoPackage, GeoJSON, Shapefile, KML or spatial databases. Further, most GIS tools such as QGIS, ArcGIS and FME build upon GDAL for data interoperability which makes OpenDRIVE comfortably usable in GIS with our solution.

Complementarily, a conversion to OGC CityGML with r:trån [3] offers advanced OpenDRIVE validation and integration into 3D city models (urban digital twins).

Additional benefits

- Straightforward data publishing with web mapping and data exchange services through OGC APIs or WMS/WFS.
- Integration into Python and Java processing through bindings provided by GDAL, apart from native C++ support.

We elegantly combine already available open-source libraries.

Outlook

Topological integrity of generated geometries is still under evaluation.

Our approach is easily applicable to other transportation domains such as railway systems where infrastructure is often modelled in railML. A tailored GDAL driver could make railML similarly integrable in GIS applications.

[1] DOI 10.5281/zenodo.5884351
[2] DOI 10.5281/zenodo.7771707
[3] DOI 10.5281/zenodo.7702312