INTRODUCING POSETTA

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Background

In geodesy we often deal with lists of coordinates and/or velocities of ground markers and GNSS stations. These lists come in many shapes and sizes. Often the points are represented in text files in a structured format but they can just as easily be presented as a binary file in various formats. The files can be generated by widely used software such as Bernese or perhaps by software only meant for internal use in a national geodetic office.

An example of the latter is the KMS-format used in Denmark. KMS files come as unstructured text files that are particularly difficult to parse by standard text import tools. Similarly much work in Norway is based on the SOSI and FRI formats. Converting between various file formats is often challenging making data exchange from one software to another difficult.

One possible solution would be a standard file format for exchange of geodetic data. Currently no definitive standard file format for exchange of coordinates and velocities has been agreed upon in the geodetic community. While such a format would indeed be nice to have, it is near impossible to get to a stage where a single format is agreed as the work to implement it everywhere would be immense.

Instead, we propose a new software that seamlessly converts between all common formats. The inspiration to this approach comes from tools such as GDAL and PDAL used in the world of remote sensing with great success. The new software for converting between geodetic file formats has been named **Posetta**, obviously a play on words, in that this is a sort of Rosetta Stone for positions.

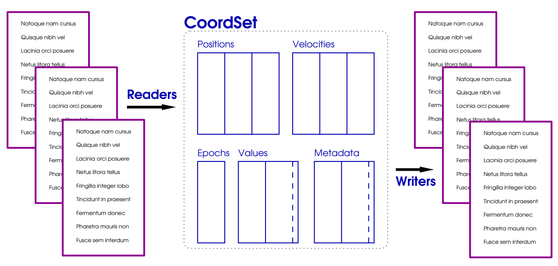

Figure 1: The `CoordSet` is the internal representation of coordinates

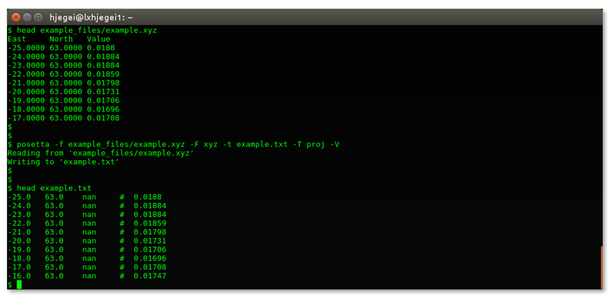

Figure 2: Using Posetta as a command line program

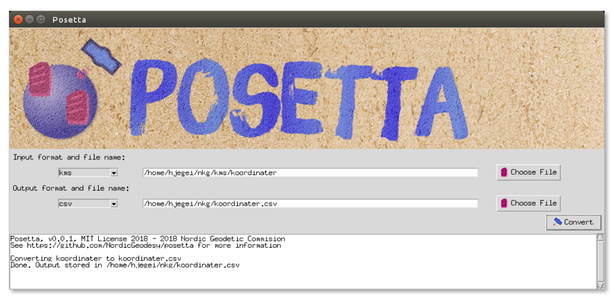

Figure 3: The graphical user interface of Posetta

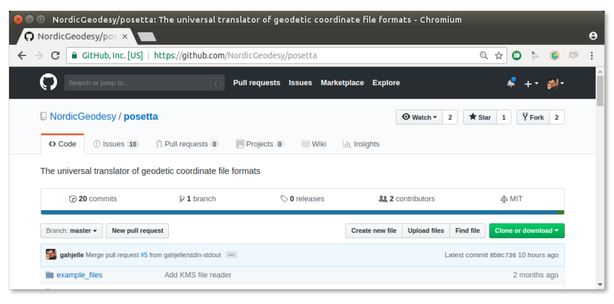

Figure 4: You can download or contribute to Posetta at Github

Technology

Posetta is written in Python. It is supported on Windows, MacOS, and Linux running Python 3.6 or later. Posetta can be used either as a command line program (see Figure 2) or through a graphical user interface (see Figure 3).

Posetta has a fairly simple architecture, built around something we call a `CoordSet`. The `CoordSet` is a class that represents a set of coordinates, either as a list of points or as a grid (see Figure 1. The `CoordSet` consists of tables with information about the position, velocity, epoch, measurement values, and other metadata for each point.

Furthermore:

- Posetta has **readers**. Each reader can read one format and convert it to a `CoordSet`.
- Posetta has **writers**. Each writer can convert a `CoordSet` to a format and write it to file.

Using these readers and writers, we can convert from any supported input format to any supported output format.

The `CoordSet` can also easily be converted to `numpy` arrays [2] or `pandas` dataframes [1]. This means that you can also take advantage of Posetta's readers and writers inside your own Python programs.

Input and Output Formats

At the moment only a few formats have been implemented (indicated in **bold** below). However the plan is to add all the formats in common use within the NKG. Please let us know if you use any formats not listed. Either write its name below, or post an issue or contribute code at `github.com/nordicgeodesy/posetta`.

Input Formats

- BIN - Binary grid format
- **CSV** - General comma separated text format
- FRI - Norwegian free form text format
- GRI - Text grid format (BIN companion)
- **KMS** - Danish coordinate format
- **PROJ** - Column based text format
- SOSI - Norwegian geodata format
- Where Dataset
- **XYZ** - Three column text format

Output Formats

- BIN - Binary grid format
- **CSV** - General comma separated text format
- FRI - Norwegian free form text format
- GRI - Text grid format (BIN companion)
- KMS - Danish coordinate format
- **PROJ** - Column based text format
- SOSI - Norwegian geodata format
- Where Dataset
- XYZ - Three column text format

Suggestions

Demo

Here are some examples of how to use Posetta as a command line program:

Get help and information about the program

```
$ posetta -h
```

Convert file from XYZ format to CSV format

Options `-f`, `-F` are used to specify which file and format to convert from. Options `-t`, `-T` specify which file to convert to.

```
$ posetta -f example.xyz -F xyz -t example.csv -T csv
```

Combine with PROJ to transform coordinates in a CSV file

If no input or output file is specified, Posetta will read from `stdin` or write to `stdout` respectively. Posetta can therefore be combined with other programs in a pipeline. The following uses PROJ (`cct`) [3] to transform from UTM32 coordinates to longitude and latitude.

```
$ posetta -f utm32.csv -F csv -T proj \
    | cct +proj=utm +zone=32 +ellps=GRS80 \
    | posetta -F proj -t longlat.csv -T csv
```

GitHub as a Development Platform

Posetta is being developed as an open NKG project at GitHub (see Figure 4). At `github.com/nordicgeodesy/posetta` anybody (not only NKG members) can download the software, report bugs and issues, or contribute code to the project.

To try the software for yourself, simply go to Posetta's GitHub web page and follow the instructions. As Posetta is still in prototype status, you need to install Python manually before installing Posetta. We plan to simplify the installation process as Posetta matures.

References

[1] McKinney, W., Data structures for statistical computing in python, in van der Walt, S., Millman, J. (eds.), *Proceedings of the 9th Python in Science Conference*, pp. 51–56, 2010.

[2] Oliphant, T. E., *A guide to NumPy*, Trelgol Publishing, 2006.

[3] PROJ contributors, *PROJ coordinate transformation software library*, Open Source Geospatial Foundation, 2018.
URL `https://proj4.org/`

`github.com/nordicgeodesy/posetta`