Geomatics Graduation Topic:  
4D-, 5D-, nD- dimensional modelling

Graduation theme: Modelling, Multi-scale and Visualization

Company or institution: TU Delft in cooperation with NWO

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Website: URL of website (if applicable).

Project duration: 6 months

Requirements and skills: For example ‘knowhow of Matlab’.

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Introduction
Besides the 3D and multi-scale aspects of geo-information, there is a need to handle other dimensional aspects of geo-information such as the temporal aspect (usually referred to as 4D). Examples of a growing need for 4D applications are monitoring spatial phenomenon (climate change), monitoring changes in a set of related features (merging or splitting parcels), monitoring changes in the characteristics of a particular feature (number of passing cars per hours at a location), and maintenance of temporal aspects within DBMS (e.g. to be able to move to an older snapshot of the database). The nD data modelling approach as currently studied within the Section GiSt will lay a foundation for higher dimensional modelling in GIS. This new way of spatial data modelling will enable full integration of the separate dimensional aspects of GIS, such as 2D/3D space, time and also scale. The resulting multidimensional partitioning will contain a highly formal definition of the dimensional concepts of geo-data allowing optimal flexibility to define specific semantics for each feature type and each dimension separately.

Proposed Graduation Topic(s)
Some example accompanying research challenges for nD modelling to which a MSc student can contribute are:

- Applying the theory of multi-dimensional modeling to the practice of geo-information modeling such as 2D+scale (i.e. vari-scale maps) and 3D+scale (as integrated 4D solution of the current separate modelling of levels-of-detail in city models).

- Implementation of higher dimensional data types in DBMSs

- Accordingly, modelling dimensional aspects of geo-information in a DBMS and to define feature types with nD primitives.

- Spatial indexing of nD objects within or outside a DBMS.