User-centric geospatial analytics and visualization of catastrophe risk portfolio using the example of the insurance industry

by **Lin Zhu**

This thesis research focuses on the large point dataset and proposes a visualization strategy with a hierarchical visual prototype considering users' information appetites for exploring the dataset in different granularities. To verify the effectiveness of proposed visualization strategy, this thesis implemented the proposed visualization strategy into the insurance industry using the catastrophe (CAT) portfolio dataset provided by Allianz Global Corporate & Specialty (AGCS).

Motivation

Visualization strategies should be able to solve two main tasks:

1) presenting the important information with little distortion, 2) Assisting exploratory queries even for massive datasets[1].

To maximize the valuable information can be conveyed to users, methods on processing and visualizing not only need to take characteristics of the dataset but users' requirements and background into account. This induces the research needs on exploring an efficient visualization strategy for large point dataset which is also flexible to be customized based on user requirements.

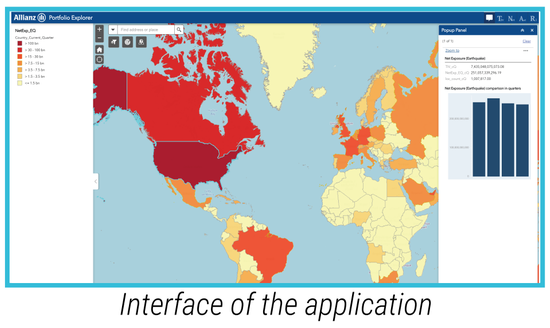
Objective

this research aims at proposing a visualization strategy with flexible visual prototype considering users' information appetites for exploring large point dataset. Results from the research are expected to provide theoretical and practical insights which are beneficial for processing and visualizing the large spatial point dataset.

Case study

As for an insurance company, its portfolio which consists of certain locations and multiple risk metrics has great affection on the dispersion and degree of potential risk.Case from AGCS provides an example that processing and visualizing the large amount of point dataset (CAT risk portfolio dataset) to users efficiently is challenge. In AGCS, there are different end-user groups, i.e. portfolio managers, underwriters, have the need on understanding the trend and distribution of exposure and potential loss via CAT risk portfolio dataset. Although, a Web-GIS platform called CATlas -portfolio explorer currently available online for users to explore the dataset at certain extent, it is still not sufficient to assist users in some working cases. Therefore, using AGCS as a study case by implementing the proposed visualization strategy to further optimize CATlas-portfolio explorer has important implication for the whole research.

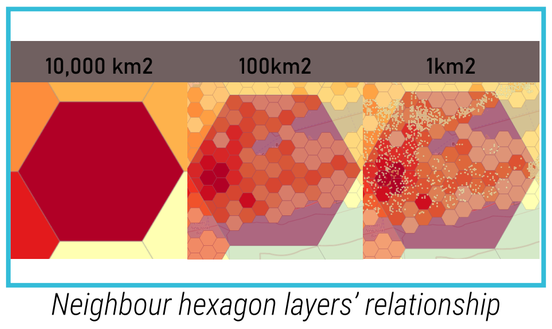
1.Layout design



Interface of the application

Design of the application layout inherited the style of default Jewelry Box Theme (one type of web app theme which puts main widgets in the left of the app) from ArcGIS web app builder.

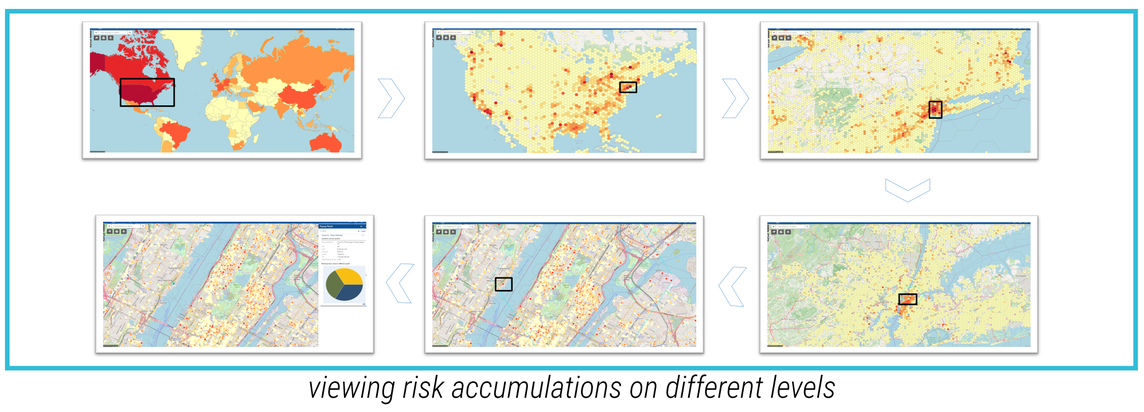
2. Hexagon system



Neighbour hexagon layers' relationship

The hexagon system supports an explorative procedure that users can identify interested searching range based on lower resolution hexagon layer and explore interested region on the higher resolution hexagon layer by simply zooming

3. Achieved scenario

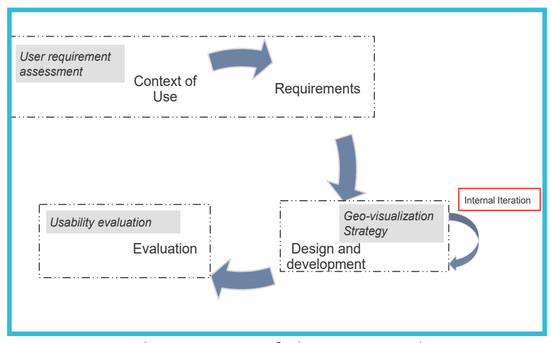


viewing risk accumulations on different levels

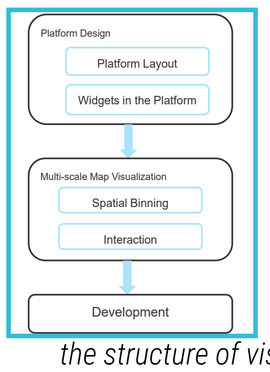
This scenario is regarded as the most basic but important one to support users on grasping the distribution of the portfolio (based on interested metrics), detecting high-valued locations and steering how value changes with the time.

Methodology

This thesis research follows the rule of user-centred design to plan the workflow, then finds strategies for the visualization problem. An interactive geo-visualization platform was proposed to be built for supporting multi-scale visualization of point location values.



The set-up of the research



the structure of visualization strategy

An interactive geo-visualization platform was proposed to be built for supporting multi-scale visualization of point location values.

Conclusion

The visualization strategy consists of multi-resolution global hexagon layer system in this thesis has been verified its' effectiveness for visualizing the large point dataset in research's study case. Combing with dedicated functions designed according to different users' requirements, it can finally promote into a comprehensive visualization solution for complexed cases.

Thesis Conducted at

Chair of Cartography
Department of Aerospace and Geodesy
Technische Universität München

Technische Universität München

Thesis Assessment Board

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Reviewer: Dr. Paulo. Raposo, ITC

Year

2020

Keywords

Geo-visualization, Data Aggregation, Risk Managment

References

[1] Keim, D. A., & Schneidewind, J. (2005). Scalable Visual Data Exploration of Large Data Sets via MultiResolution. Journal of Universal Computer Science, 11(11), 1766-1779UR - http://kops.uni-konstanz.de/handle/123456789/5449. https://doi.org/10.3217/jucs-011-11-1766[2] All citations in this list must be referenced in the text.

This master thesis was created within the Cartography M.Sc. programme – proudly co-funded by the Erasmus+ Programme of the European Union.

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