### **NCVA**







#### Implementation and Evaluation of a Flow Map Demonstrator for Analyzing Work Commuting Flows between Norway and Sweden

Quan Ho, Hai-Phong Nguyen, Mikael Jern NCVA, ITN, Linköping University

http://ncva.itn.liu.se





#### Applied Research based on geovisual

analytics in close collaboration with governments and companies





IN PARTNERSHIP WITH THE Knowledge Foundation Trade Flow Map



#### **Road Risk Management**



VINNOVA



## Motivation

- Movements such as migration and commuting are important to policy makers.
- Statistics foundations need a tool to show trends and discoveries to policy makers as well as to public through internet.
- $\square \Rightarrow$  A motivation for development of an interactive web-enabled visualization tool for flow data.





### Flow Data Types and Statistics Partners

- Migration and commuting across the border between Sweden and Norway (Ostfold Fylke, Norway)
- Commuting among counties/municipalities in Sweden (Statistics Sweden)
- Trade flows (export, import) among countries (OECD)



### Main Requirements from Partners

- Flow visualization
  - Single origin
  - Multi-origins
- Comparison, finding trends and hubs
- Time series visualization
- Interaction
- Supporting analysis



## Flow Visualization

- Use directed weighted arrows
- Show both flows back and forth for comparison
- Use quadratic Bezier curves to increase readability
- Use a dynamic filter to display only the flows of interest
- Use Google map/Bing map for projection and background





#### Flow Data Visualization and Comparison





#### Flow Data Visualization and Comparison





#### **NCVA**

### Top Flows, Top Hubs

#### **Top flows**

Commuting to	To / From	Focus
2,3	Västra Götaland	Oslo
1,6	Värmland	Oslo
1,1	Värmland	Akershus
1,1	Västra Götaland	Østfold
8	Skåne	Oslo
ε	Västra Götaland	Akershus
7	Stockholm	Oslo
7	Värmland	Hedmark
e	Värmland	Østfold
5	Östergötland	Oslo

#### Top hubs-in

County Name	Commuting In V
Oslo	10,161
Akershus	3,779
Østfold	2,096
Vestfold	1,434
Hedmark	1,177

#### Top hubs-out

County Name	Commuting Out <b>v</b>
Västra Götaland	6,355
Värmland	5,103
Skåne	1,857
Stockholm	1,786
Dalarna	1,285





#### Time Series Visualization (cont.)





## Interaction

CVA

- Selection
- Panning
- Zooming
- Linking
- Filtering
- Tooltip





### Using Region Data To Support Analysis



#### Regions are colored according to income





#### Using Region Data To Support Analysis



#### PCP displays region indicators



#### OECD Trade Flow Map





#### OECD Trade Flow Map (cont.)





#### GAV Flash Framework





**Choropleth Map** 







Scatter matrix



**Table lens** 





#### **Component Levels**







#### Glyph layer Gulf of Bothnia Arrow layer Shape layer HIMI Nykoping **Baltic Sea** tervik Border Map layer Aalborg Helsingborg Q Karlskrona stad Køben Google Map layer Daguark Kartdata pies, Geocentre Consulting, Tele Atlas



### User Feedback

- Prototypes are being used by several partners (Statistics Sweden, Ostfold Fylke)
  - To analyze in depth the geographic structures and identify trends:
    - There is an increasing trend that more Swedes prefer to commute to Norway than the reverse scenario.
    - This creates a serious tax reduction for Sweden (that is about 20 billion SEK ≈ 2.2 billion EUR) because these people live in Sweden but pay taxes in Norway where they work.





#### User Feedback (cont.)

NCVA

 To communicate the results to a wide range of users via their web site and catch the attention of the media and policy makers;









#### User Feedback (cont.)

- Positive feedback from the partners
- Supporting better understanding of both commuting and migration between sub-national regions and across national borders.
- Online applications

http://vitagate.itn.liu.se/GAV/flowmap/





#### Future Work

- Working with large datasets
- Improving GUI
- Using storytelling for better communication of discoveries
- Performing a thorough evaluation





#### Acknowledgements



Statistiska centralbyrån Statistics Sweden













Thank you for your attention

# Questions & & Discussion