CS543 – Term Project
E-commerce System User Behavior Visualization

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Introduction

- E-commerce web sites have been highly used by people and the competition between these type of web sites **to attract customer has increased**.

- Having strong **data insights** and analyze user behaviors to provide relevant products and offer special campaigns to the customers

- To have such insights, data visualization techniques can be used as a practical tool.

Dataset

- Transactions between 01/12/2010 and 09/12/2011 for a UK-based online retail website.

- 541909 rows, Number of people: **4339,** Number of products: **3941**

	InvoiceNo	StockCode	Description	Quantity	InvoiceDate	UnitPrice	CustomerID	Country
541889	581585	22466	FAIRY TALE COTTAGE NIGHT LIGHT	12	12/9/2011 12:31	1.95	15804.0	United Kingdom
541890	581586	22061	LARGE CAKE STAND HANGING STRAWBERY	8	12/9/2011 12:49	2.95	13113.0	United Kingdom
541891	581586	23275	SET OF 3 HANGING OWLS OLLIE BEAK	24	12/9/2011 12:49	1.25	13113.0	United Kingdom
541892	581586	21217	RED RETROSPOT ROUND CAKE TINS	24	12/9/2011 12:49	8.95	13113.0	United Kingdom
541893	581586	20685	DOORMAT RED RETROSPOT	10	12/9/2011 12:49	7.08	13113.0	United Kingdom
541894	581587	22631	CIRCUS PARADE LUNCH BOX	12	12/9/2011 12:50	1.95	12680.0	France
541895	581587	22556	PLASTERS IN TIN CIRCUS PARADE	12	12/9/2011 12:50	1.65	12680.0	France
541896	581587	22555	PLASTERS IN TIN STRONGMAN	12	12/9/2011 12:50	1.65	12680.0	France
541897	581587	22728	ALARM CLOCK BAKELIKE PINK	4	12/9/2011 12:50	3.75	12680.0	France
541898	581587	22727	ALARM CLOCK BAKELIKE RED	4	12/9/2011 12:50	3.75	12680.0	France
541899	581587	22726	ALARM CLOCK BAKELIKE GREEN	4	12/9/2011 12:50	3.75	12680.0	France
541900	581587	22730	ALARM CLOCK BAKELIKE IVORY	4	12/9/2011 12:50	3.75	12680.0	France
541901	581587	22367	CHILDRENS APRON SPACEBOY DESIGN	8	12/9/2011 12:50	1.95	12680.0	France

Data Preprocessing

- Grouping into carts, calculating cart amounts, dropping nan values, grouping operations

- Transactions: **20726** rows

InvoiceNo	CartAmount	InvoiceDate	PurchasedItems	StockCodes	CustomerID	Country	InvoiceDay
536365	139.12	12/1/2010 8:26	[WHITE HANGING HEART T-LIGHT HOLDER, WHITE MET...	[85123A, 71053, 84406B, 84029G, 84029E, 22752,...	17850	United Kingdom	2010-12-01
536366	22.20	12/1/2010 8:28	[HAND WARMER UNION JACK, HAND WARMER RED POLKA...	[22633, 22632]	17850	United Kingdom	2010-12-01
536367	278.73	12/1/2010 8:34	[ASSORTED COLOUR BIRD ORNAMENT, POPPY'S PLAYHO...	[84879, 22745, 22748, 22749, 22310, 84969, 226...	13047	United Kingdom	2010-12-01
536368	70.05	12/1/2010 8:34	[JAM MAKING SET WITH JARS, RED COAT RACK PARIS...	[22960, 22913, 22912, 22914]	13047	United Kingdom	2010-12-01
536369	17.85	12/1/2010 8:35	[BATH BUILDING BLOCK WORD]	[21756]	13047	United Kingdom	2010-12-01
536370	855.86	12/1/2010 8:45	[ALARM CLOCK BAKELIKE PINK, ALARM CLOCK BAKELI...	[22728, 22727, 22726, 21724, 21883, 10002, 217...	12583	France	2010-12-01
536371	204.00	12/1/2010 9:00	[PAPER CHAIN KIT 50'S CHRISTMAS]	[22086]	13748	United Kingdom	2010-12-01
536372	22.20	12/1/2010 9:01	[HAND WARMER RED POLKA DOT, HAND WARMER UNION ...	[22632, 22633]	17850	United Kingdom	2010-12-01
536373	259.86	12/1/2010 9:02	[WHITE HANGING HEART T-LIGHT HOLDER, WHITE MET...	[85123A, 71053, 84406B, 20679, 37370, 21871, 2...	17850	United Kingdom	2010-12-01
536374	350.40	12/1/2010 9:09	[VICTORIAN SEWING BOX LARGE]	[21258]	15100	United Kingdom	2010-12-01

Data Sampling

- Number of people: **4339**
- Number of products: **3941**
- Number of edges: **387875**
- Sampled of people and products for better visualization on graph

RELATIVELY BIG NETWORK
- Sampling of people who have purchased more than 200 products
- Sampling of products by if this product is added to cart more than 100 times
- Number of people: **454**
- Number of products: **1541**
- Number of edges: **169740**

RELATIVELY SMALL NETWORK
- Sampling of people who have purchased more than 400 products
- Sampling of products by if this product is added to cart more than 1000 times
- Number of people: **139**
- Number of products: **39**
- Number of edges: **10481**

Force-Directed Graph Visualization

Grey Nodes: People, **Blue** nodes: Products
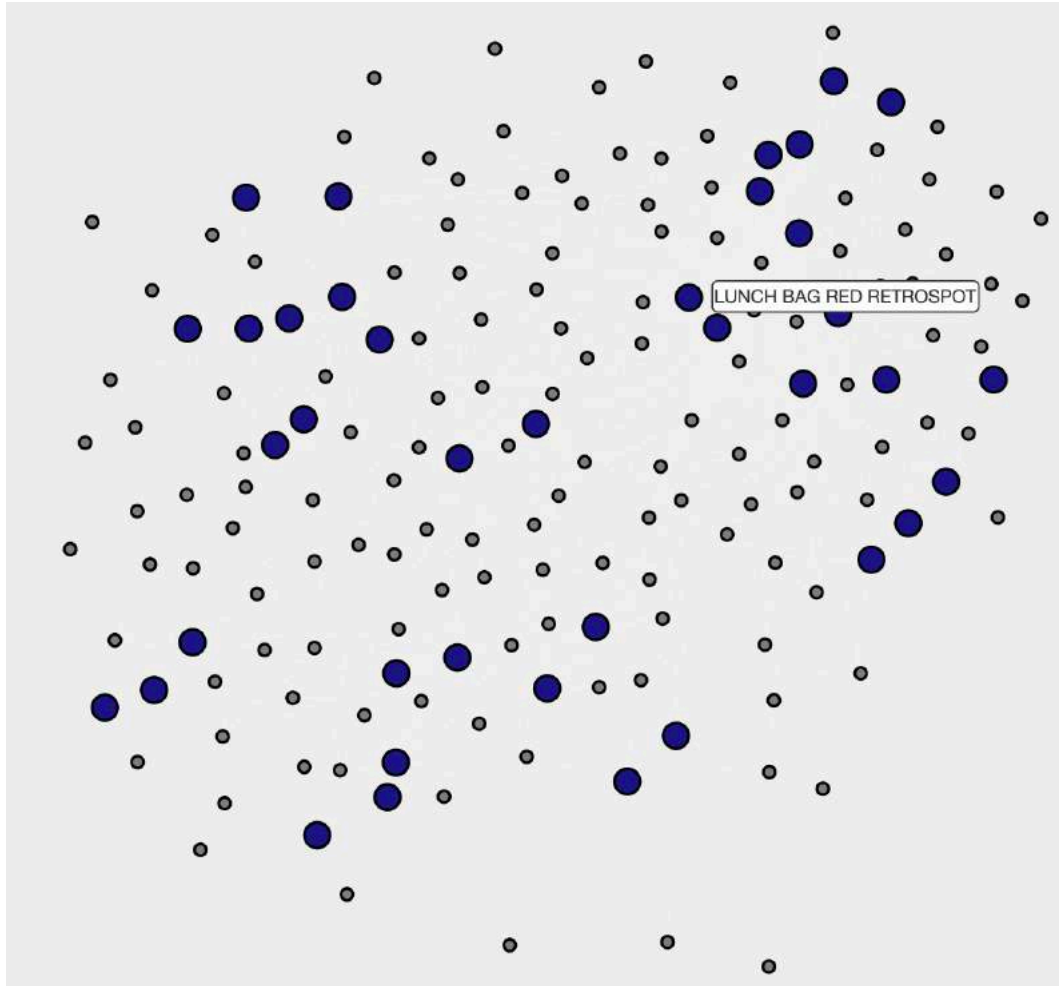
SMALL NETWORK: 178 NODES, 10841 Edges
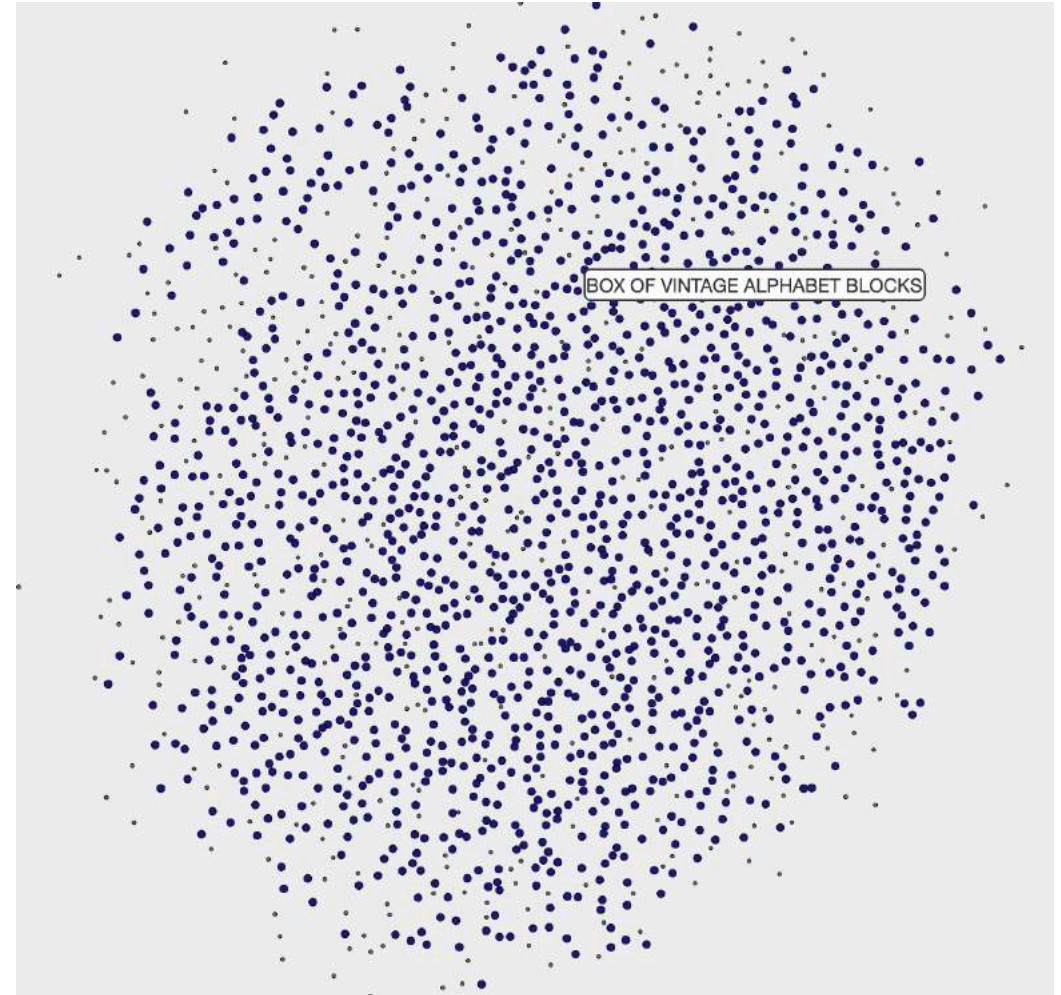
BIG NETWORK: 1995 NODES, 169740 Edges
(it is zoomable on tool)

Force-Directed Graph Visualization

People – Product Interactions
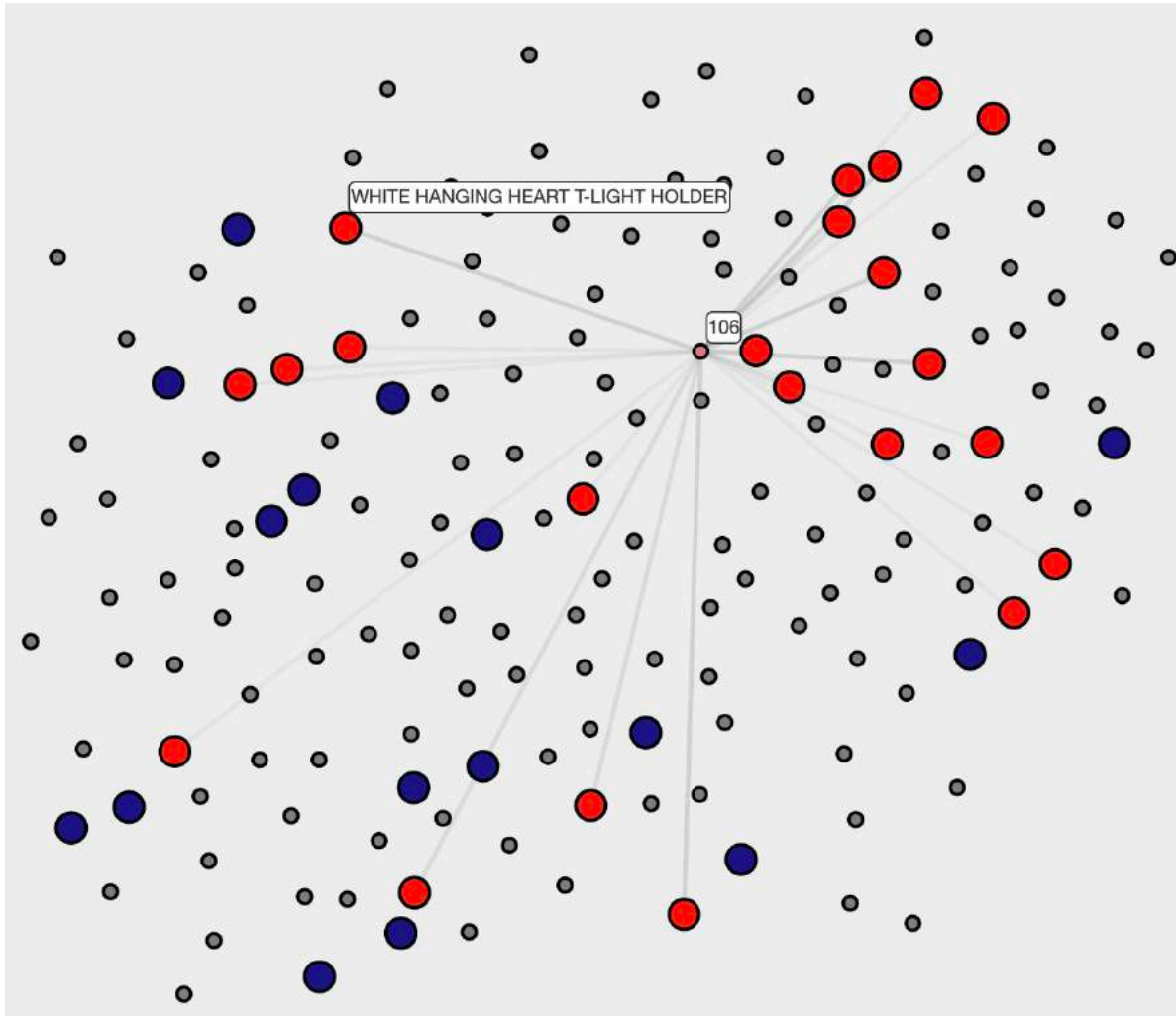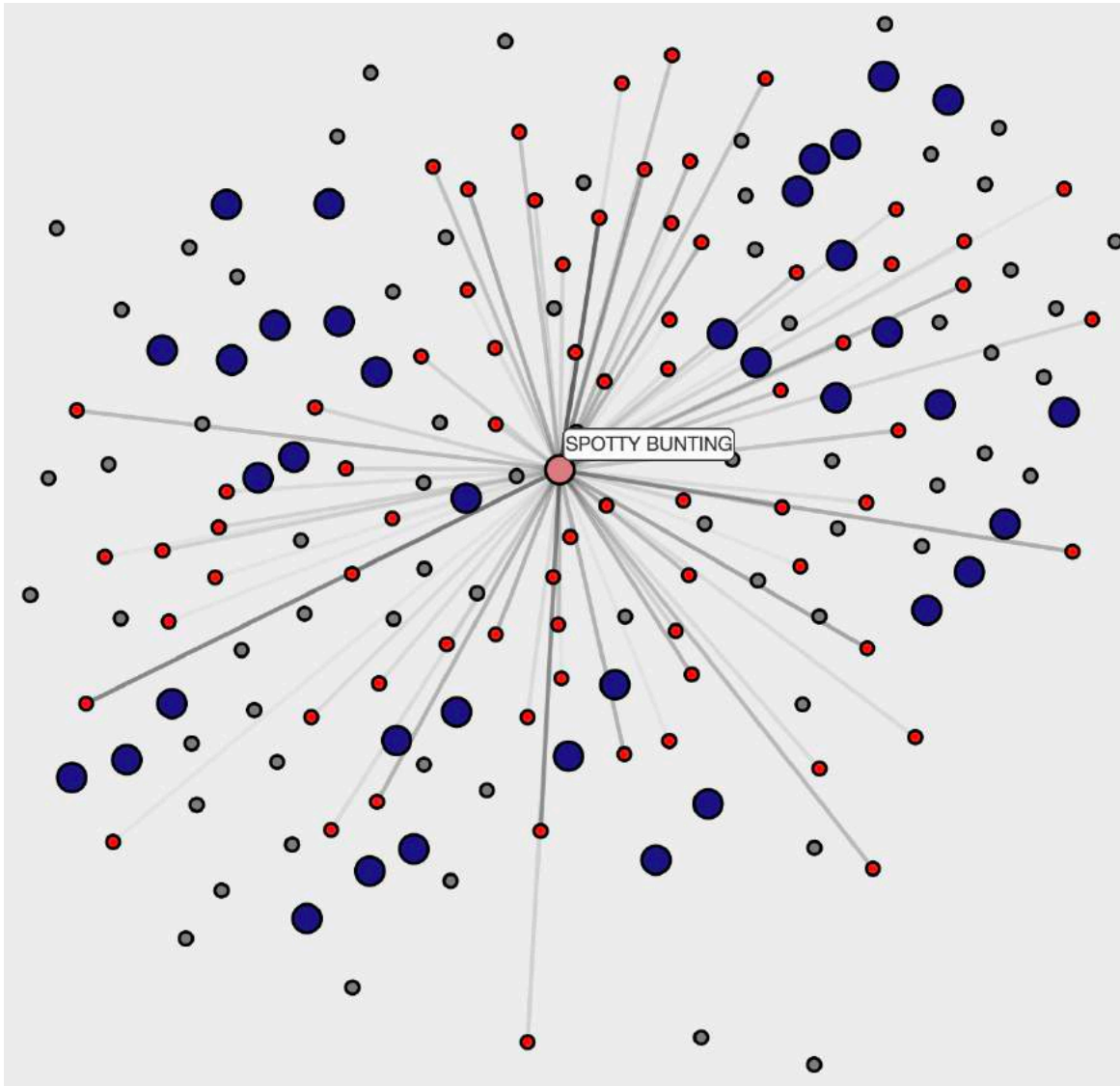

Grey Nodes: People, **Blue** nodes: Products
Pink Node: Center User to be analyzed (User ID: 106)
Red Nodes: The products which that user purchased

- To analyze a user to buy which products
- To understand user interests and can be used to offer special campaigns
- To understand common interests between people

Force-Directed Graph Visualization

Product – People Interactions

Grey Nodes: People, **Blue** nodes: Products
Pink Node: Center User to be analyzed (User ID: 106)
Red Nodes: The people which purchased that product

- To analyze a product: who purchased that product
- To understand common interests between people

Scatter Visualization

User Activity Visualization
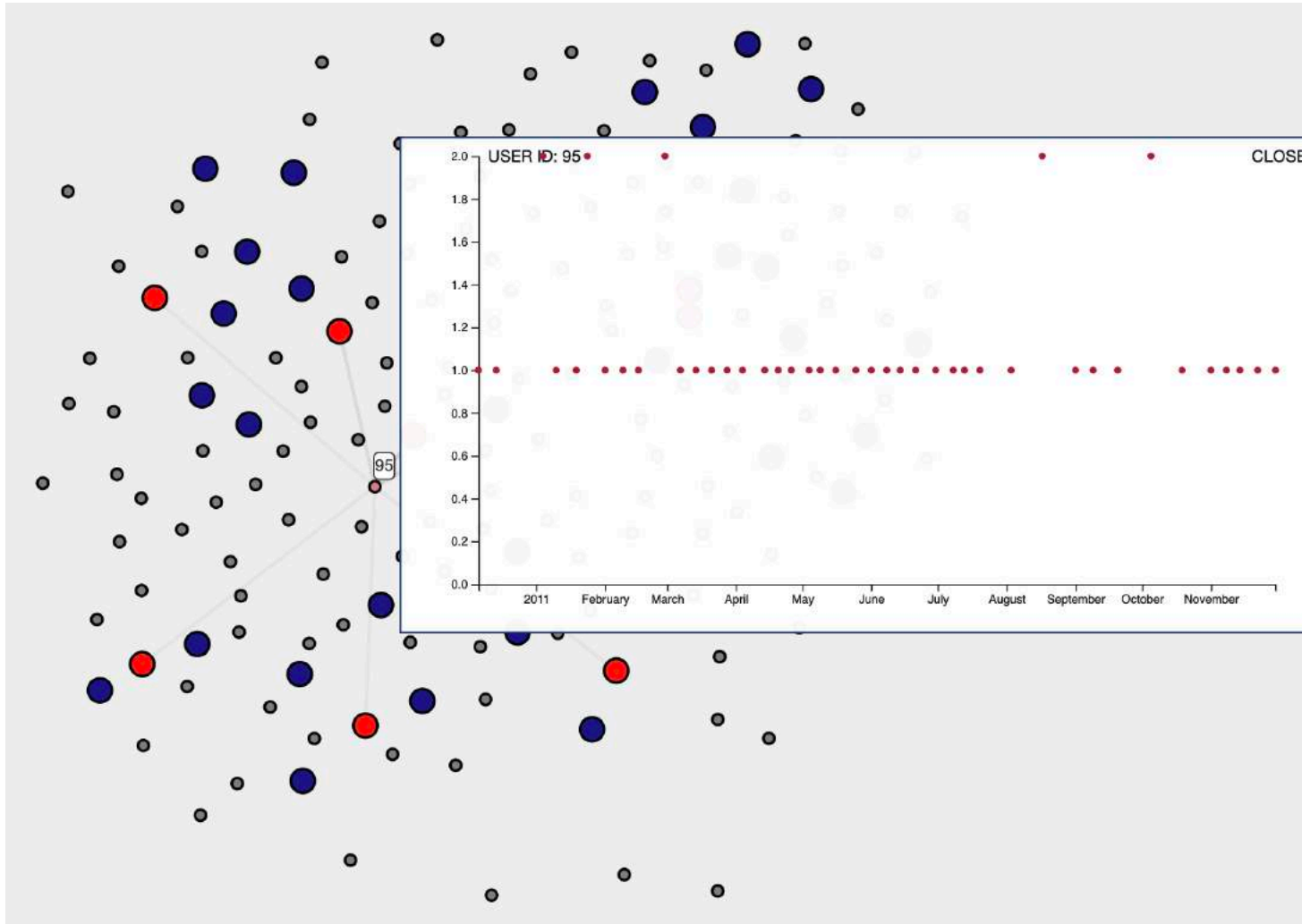
Grey Nodes: People, **Blue** nodes: Products
Pink Node: Center User to be analyzed (User ID: 95)
Red Nodes: The products which that user purchased

User Interaction Scatter Plot:
- How many products that user purchased on timeline
- To analyze user activity on the website
- To send special campaign emails to attract passive users
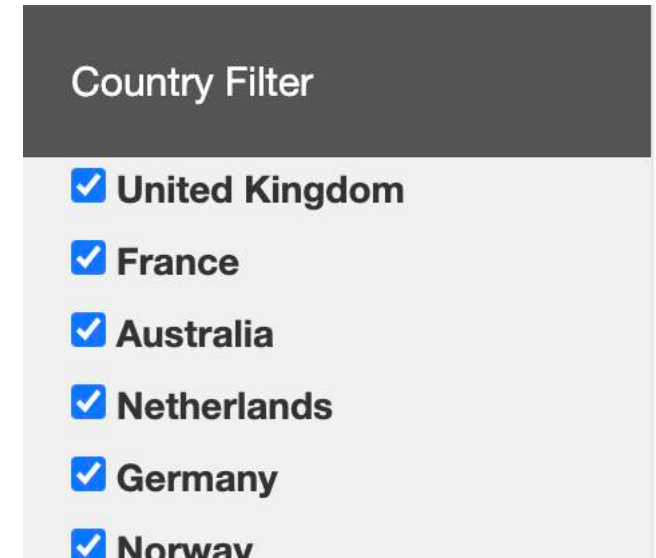
Linechart Visualization
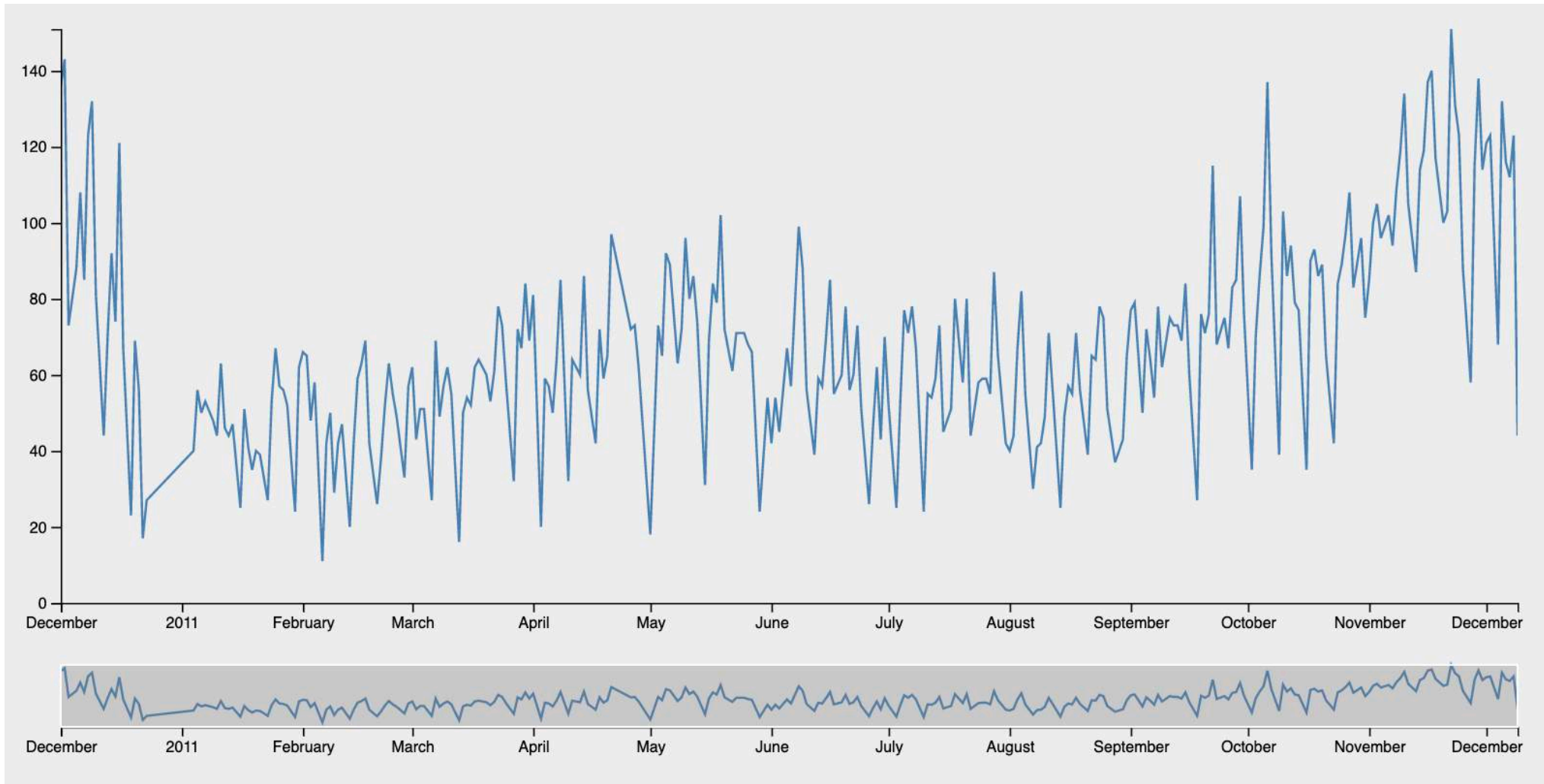
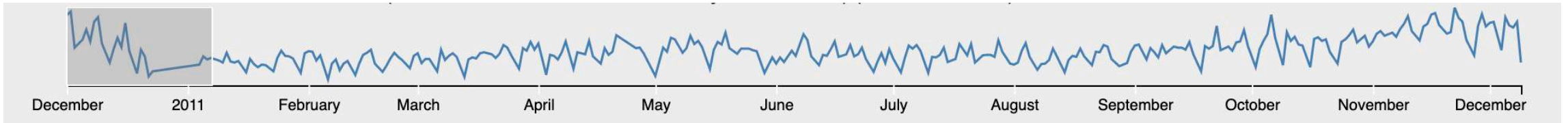Number of transactions over time

Filters

Country Filter

- Users can be filtered according to their countries by use of country filter that can help to analyze which countries are more active in purchasing.

- This can also help to analyze products which the people are interested in specific countries.

- It can be used to increase stocks of these products in these countries.
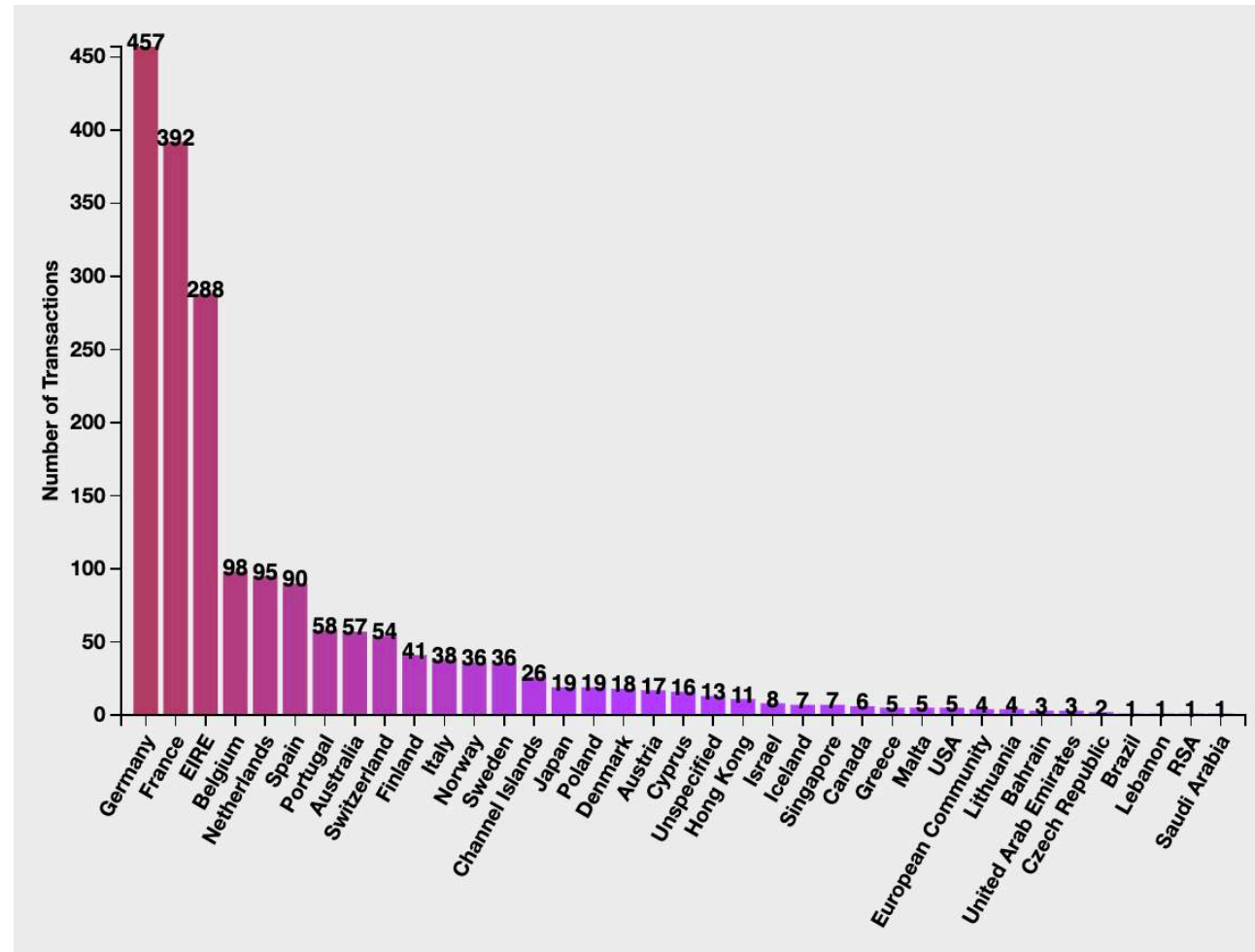

Time Filter

- Filtering of people according to a timeline, selecting an area of the timeline can allow in understanding which users made transactions and which products were purchased.
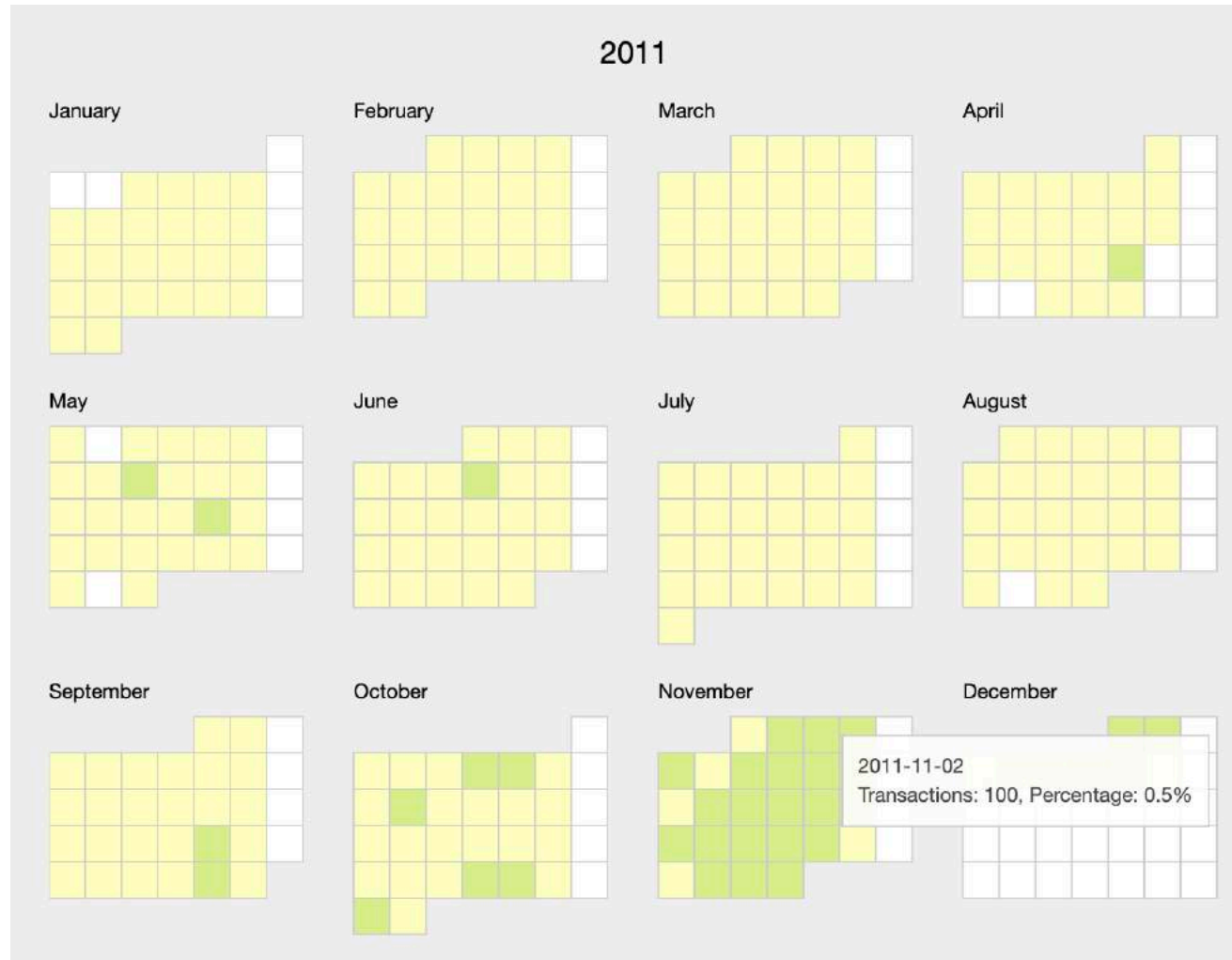
Barchart Visualization

- To analyze user transactions according to their countries

Number of transactions per country except United Kingdom (UK: 18784 transactions)
Total Number of transactions: 20726

Calendar Visualization

- To analyze user behavior on different time of the years, and days

Number of transactions in calendar view

Implementation & Demo

- Demo: https://alaattinyilmaz.github.io/ecommerce-tool/

- Implementation: https://github.com/alaattinyilmaz/ecommerce-data-visualization