Appendix A: User Study Document

1. **Tutorial**
a. Motivation: help user find a set of financial factors in factor investing effectively and relieve the pain of manual search.
b. Background:
   i. **Factor investing** is an investment approach that involves "**factors**" (some targeting quantifiable firm characteristics or interpretable variables in stock market) that can explain differences in stock returns. A **selective** collection of factors are used as input predictors and **stock returns** are set as target outcomes to build predictive financial **models**. And these trained models are used to forecast the stock returns in future and help traders construct the portfolio.
   ii. The system integrated algorithmic and interactive factor selection for portfolio construction.
c. Introduce the interface
   i. The system consists of six views: control panel(A), factor view(B), stock view(C), factor list(D), stock return view(E), and backtesting view(F).

   ii. Users can select a date range, predictive model type and an initial pool of stocks for analysis in **(A)**. And click the "Draw" button to visualize the factor performance on selected stocks in the other views.
   iii. As shown in **(B)**, the x-axis indicates the timeline. In each time unit, a factor is visualized as a filled circle, where the fill color hue indicates the type of factor(6 factors types in total), the radius of circle represents the importance of a factor for all stocks in the selected pool, and the color opacity encodes the sensitivity of factor, which you can see it as the importance of factor.
   iv. A timeline-based visual design for each stock in terms of its monthly model output in **(C)**. For each stock, there is a stock bar representing the ratio of monthly stock price change in each month centered on the x-axis, where the red bar indicates a rise of stock price and a green bar indicates a drop. The width of the bar encodes the rate of error of the predicted monthly stock price change. **The factor glyph** is designed as a circle divided into six angular sectors with the same center. Six types

of factors are displayed in these angular sectors by a clockwise order starting from "12-o'clock". The radius of each sector represents the sum of contribution in the corresponding factor type. An inner circle represents the bias of the model in that month, with the radius linearly mapped to the magnitude of the bias. The top-five factors with highest contributions in this month are displayed in the color of their own factor type. When there are more than one factors in the top five that belong to a same type, a Voronoi graph would be drawn in a size of their own contribution in the outer sector space. The sum of contributions except the top five factors in each type would be represented by the size of grey area close to the glyph center. When users hover a sector of factor, a line connecting the same factor in separate months will be shown.

- v. **(D)** is a view that shows aggregated factor data.
- vi. **(E)** and **(F)** allow users simulate a trading strategy using historical data to measure the portfolio performance.

d. Introduce the interactions

- i. Selection of factors: The user can add or remove factors by clicking on circles in **(B)**, voronoi maps in **(C)** and bars in **(D)**, Such selection will trigger update in all three views simultaneously. In this way, the user can comprehensively examine the contribution of individual factor and refine factor selection.

- ii. Selection of stocks: **(A)** is the entry point to select stocks and sectors of interest, it feeds the data to all other views. After examining the stocks of interest, users can add or remove stock in investment portfolio by clicking either the stock name in **(C)** and return line in **(E)**. This provides an interactive way for users to refine stock selection according to either the factors' performance or stock returns.

2. **Task 1:**

Data 1:

Control panel settings:
  Sector: Banking
  Time range: Jan, 2016 to Jan, 2018
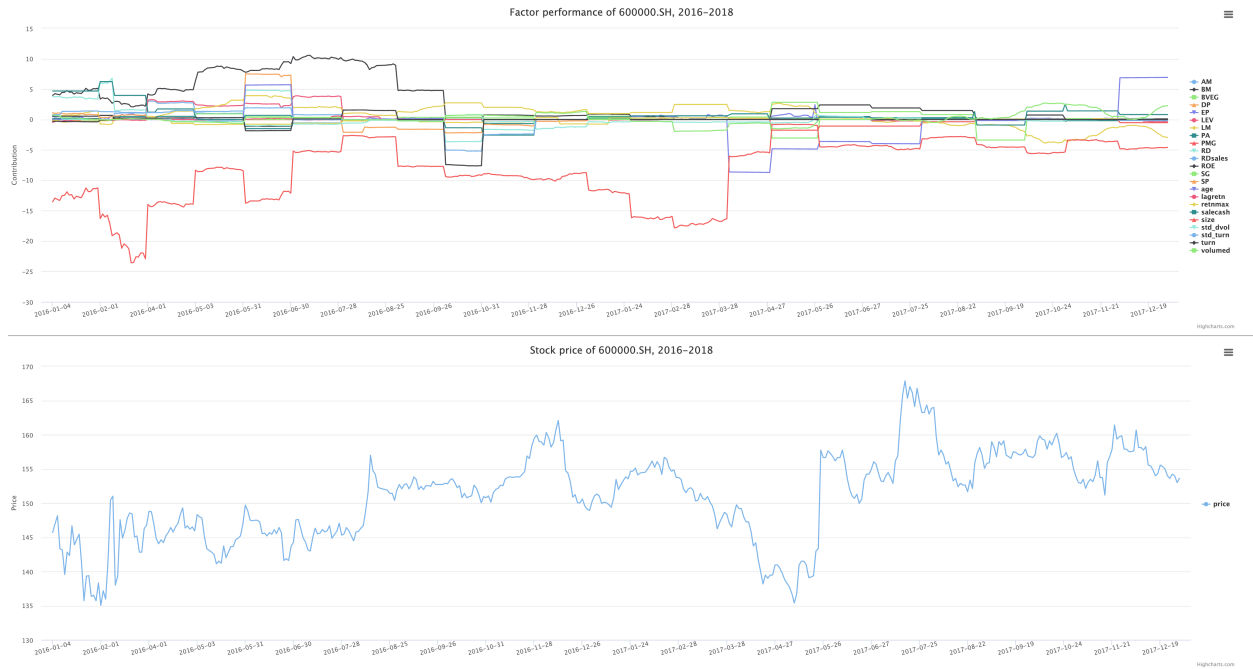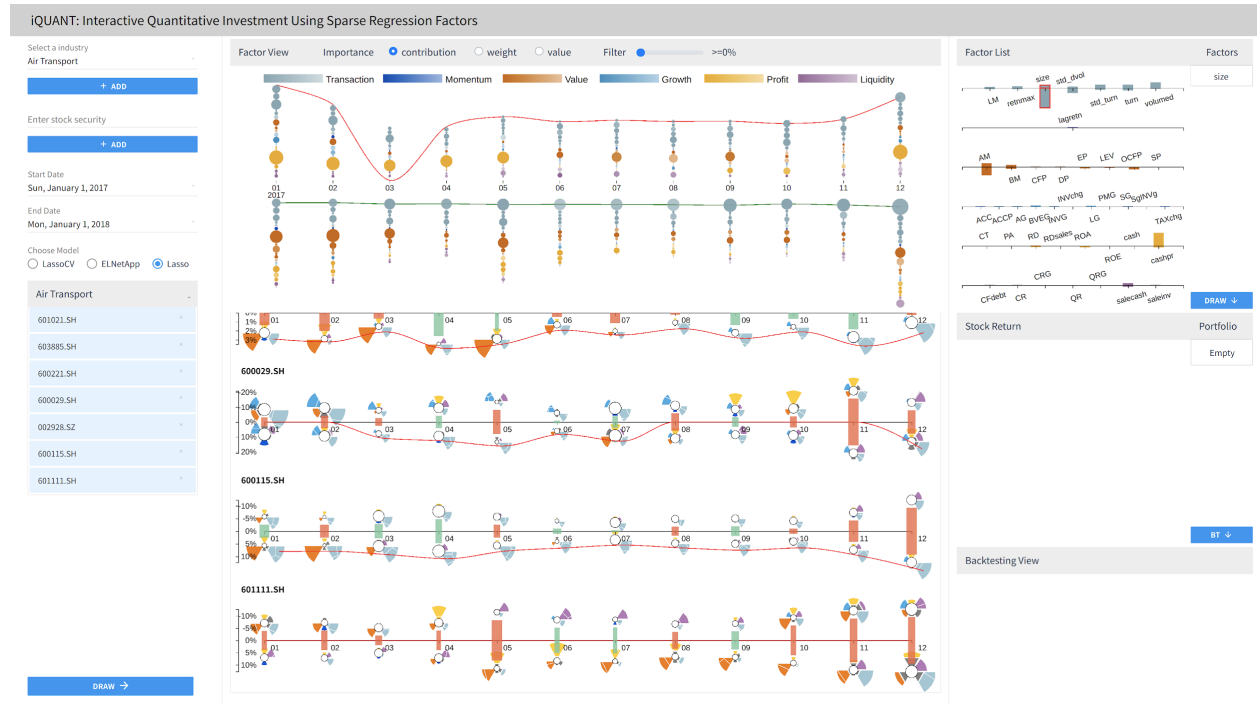 Model: Lasso
  Target security: 600000.SH

Please try to answer following questions:
1. Please select the top factors with highest **positive** contribution of 600000.SH in **stock view(C)**.
2. Please select the top factors with highest **negative** contribution of 600000.SH in **stock view(C)**.
3. Please select the top factors with most **unstable** contribution of 600000.SH in **stock view(C)**.

iQUANT:

Baseline:

Factor performance of 600000.SH, 2016–2018

Stock price of 600000.SH, 2016–2018

Data 2:

Control panel settings:
  Sector: Air transport
  Time range: Jan, 2017 to Jan, 2018
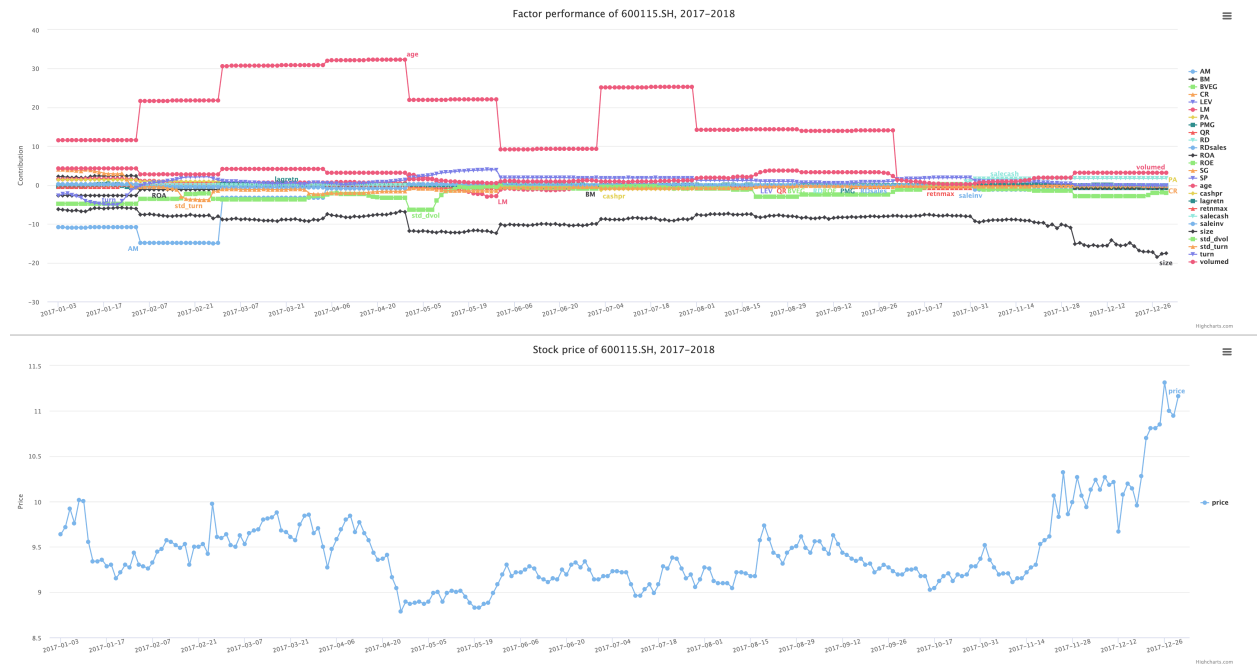 Model: Lasso
  Target security: 600115.SH

Please try to answer following questions:
1. Please select the top factors with highest **positive** contribution of 600115.SH in **stock view(C)**.
2. Please select the top factors with highest **negative** contribution of 600115.SH in **stock view(C)**.
3. Please select the top factors with most **unstable** contribution of 600115.SH in **stock view(C)**.

iQUANT:

Baseline:

3. **Task 2:**

Data 1:

Control panel settings:
   Sector: Banking
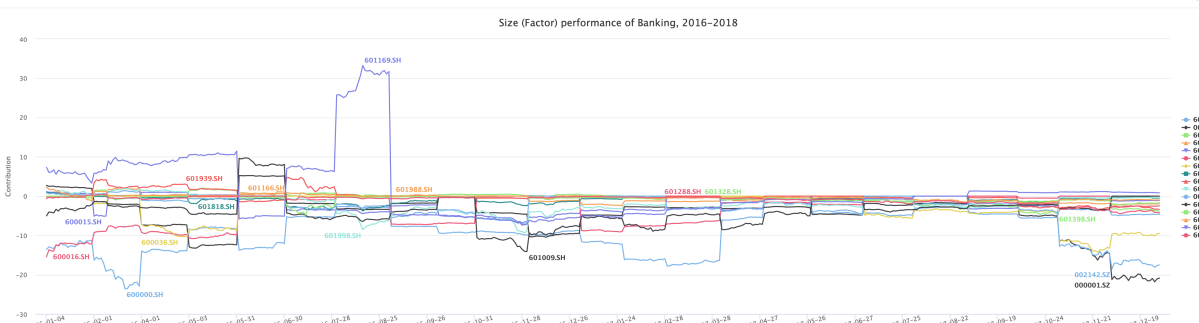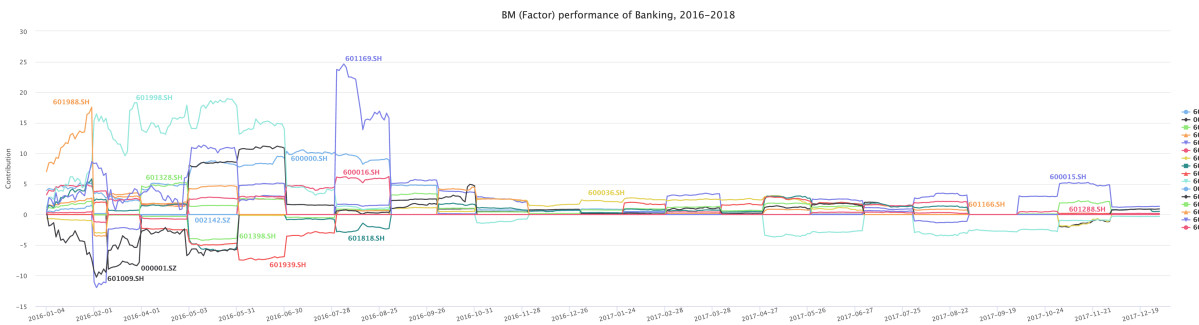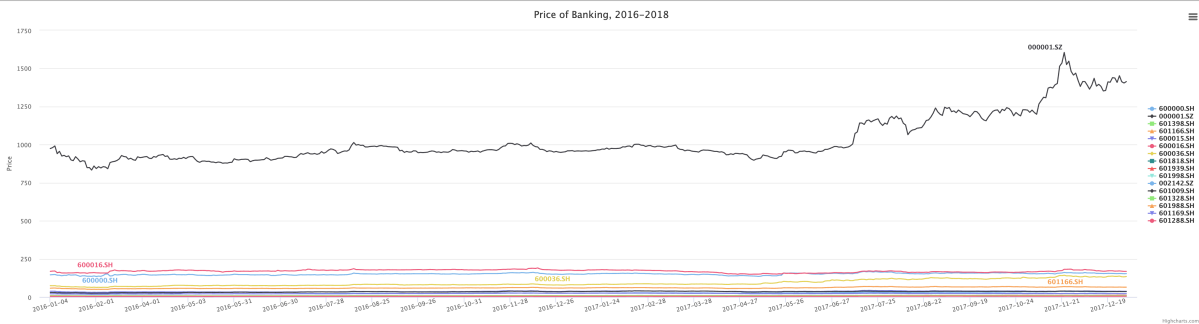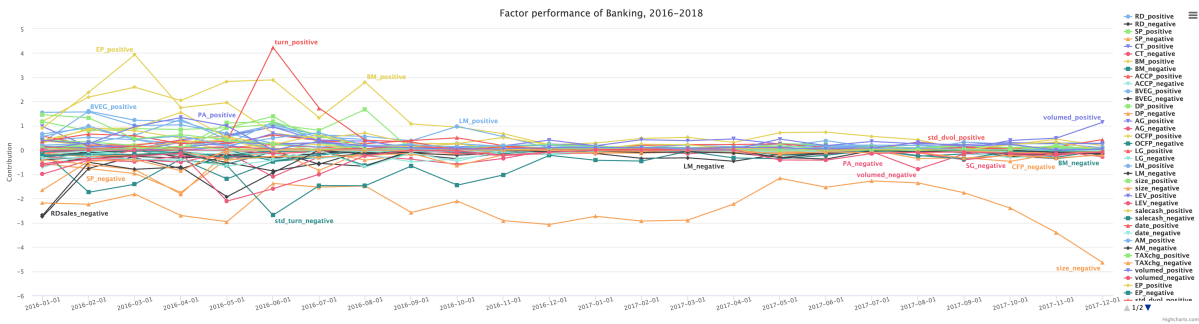   Time range: Jan, 2016 to Jan, 2018
   Model: Lasso

Please try to answer following questions:
1. Please select the factor with highest **positive** contribution of **Banking sector** in **factor view(B)**.
2. Please select the factor with highest **negative** contribution of **Banking sector** in **factor view(B)**.
3. Please select a security in **stock view(C)** according **BM** factor in which this factor has the highest positive contribution.
4. Please select a security in **stock view(C)** according **size** factor in which this factor has the highest negative contribution.

iQUANT:

Baseline:

Factor performance of Banking, 2016–2018

Price of Banking, 2016–2018

BM (Factor) performance of Banking, 2016–2018

Size (Factor) performance of Banking, 2016–2018

Data 2:

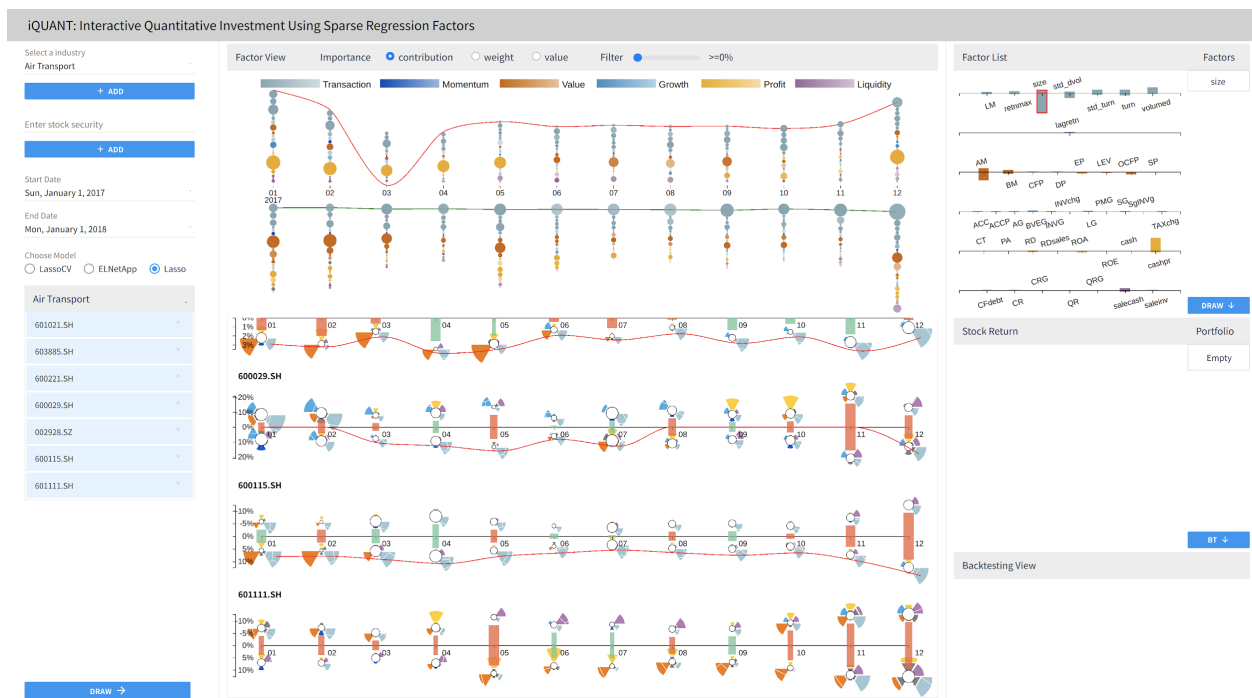 Control panel settings:
  Sector: Air transport
  Time range: Jan, 2017 to Jan, 2018
  Model: Lasso

Please try to answer following questions:
1. Please select the factor with highest **positive** contribution of **Air Transport sector** in **factor view(B)**.
2. Please select the factor with highest **negative** contribution of **Air Transport sector** in **factor view(B)**.
3. Please select a security in **stock view(C)** according **cashpr** factor in which this factor has the highest positive contribution.
4. Please select a security in **stock view(C)** according **size** factor in which this factor has the highest negative contribution.

iQUANT:

Baseline:

Factor performance of Air Transport, 2017–2018

Price of Air Transport, 2017–2018

Cashpr (Factor) performance of Air Transport, 2017–2018

Size (Factor) performance of Air Transport, 2017–2018

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