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0.1 1.0- Introduction

Honda Motor Co. Ltd. is the one of the largest automotive component manufacturers.

0.2 2.0- An Overview of Honda Motor Co. Ltd's Internationalization Strategy

Rapid Global Expansion:

Development of Local Leadership:

Business Agility:

Development New Technology through International Partnership:

(My Findings)

Details about **Honda Motor Co. Ltd. in 2012** * total patent count 8143 * total Turnover lay 144657174. * total turnover 144825890 * total asset 104917126 * total R&D 5950823.00 * Number of employees 190338

Figure 5 indicates that Honda Motor Co. Ltd. had the 3rd highest patent count for the year of 2012.

Figure 6 indicates They had the 2nd highest total turnover followed by Toyota Jidosha Kabushiki Kaisha.

Figure 7 indicates They had the 2nd highest total asset followed by Toyota Jidosha Kabushiki Kaisha .

Figure 8 indicates They had the 2nd highest total R&D followed by Toyota Jidosha Kabushiki Kaisha.

Figure 9 indicates They had the 2nd highest number of employees followed by Toyota Jidosha Kabushiki Kaisha.

Figure 10 represents correlation between variables which suggests turnover and total asset had the highest positive correlation of 1. In addition, total asset and patent count had the lowest correlation value of 0.55. Figure 11 (turover vs turnover lay) and Figure 12 (total asset vs patent count) showcases the correlation plot of that.

```
[ ]: from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

```
[ ]: #importing all the needed packages for data analysis
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings('ignore')
```

```
[ ]: #location of the IBM data
path = '/content/drive/MyDrive/Colab Notebooks/assignment/data/'
#location of all the attribute files
attribute5 = path + 'USPTO_2012_5_proj_attributes_NEW.csv'
edgelist5 = path + 'USPTO_2012_5_proj.xlsx'
```

```
[ ]: attribute_df5 = pd.read_csv(attribute5)
final_attribute = attribute_df5.drop(columns=['Unnamed: 10'])
print('total shape of attributes {}'.format(final_attribute.shape))
```

total shape of attributes (35, 10)

```
[ ]: #read all the csv files of edgelist
colnames = ['From', 'To']
edgelist_df5 = pd.read_excel(edgelist5,names=colnames)
final_edgelist = edgelist_df5
print('total shape of edgelist {}'.format(final_edgelist.shape))
```

total shape of edgelist (298, 2)

0.3 3.0- Network analysis techniques and visualizations to describe the network in which it is embedded (indicatively 700 words)

0.3.1 (Your written part)

Company Network Analysis:

Global Value Chain:

0.3.2 (My Findings)

Provided dataset **edgelist** corresponds of:

1. Number of node (companies): 399 and Number of edges(connections): 298
2. From **Figure 1** we can see that the network is a industrial network (define industrial network). From **figure 2** we can see that the network has 2 communities(yellow, blue). The community detection was done using **girvan_newman** algoirthm. Under the Girvan-Newman algorithm, the communities in a graph are discovered by iteratively removing the edges of the graph, based on the edge betweenness centrality value. The edge with the highest edge betweenness is removed first. We will cover this algorithm later in the article, but first, let's

understand the concept of “edge betweenness centrality”. (describe the three communities individually got from figure 2 newtworks)

3. Denso Corporation have number of degree = 14 which means it has total of 14 unique direct connections with companies.

```
[ ]: import networkx as nx

# Read Our Edgelist
us_graph = nx.from_pandas_edgelist(final_edgelist,source="From",target="To")
```

```
[ ]: print("Number of nodes:", us_graph.number_of_nodes())
print("Number of edges:", us_graph.number_of_edges())
```

Number of nodes: 399

Number of edges: 298

```
[ ]: us_graph.degree('Honda Motor Co., Ltd.')
```

```
[ ]: 14
```

```
[ ]: us_graph.edges('Honda Motor Co., Ltd.')
```

```
[ ]: EdgeDataView([('Honda Motor Co., Ltd.', 'Nippon Light Metal Company Limited'),
('Honda Motor Co., Ltd.', 'Takata Corporation'), ('Honda Motor Co., Ltd.',
'Nifco, Inc.'), ('Honda Motor Co., Ltd.', 'Keihin Corporation'), ('Honda Motor
Co., Ltd.', 'Illinois Tool Works Inc.'), ('Honda Motor Co., Ltd.', 'Tokai Rubber
Industries, Ltd.'), ('Honda Motor Co., Ltd.', 'Honda Access Corp.'), ('Honda
Motor Co., Ltd.', 'Novelis Inc.'), ('Honda Motor Co., Ltd.', 'NSK LTD.'),
('Honda Motor Co., Ltd.', 'Saga Tekkohsho Co., Ltd.'), ('Honda Motor Co., Ltd.',
'Nissin Kogyo Co., Ltd.'), ('Honda Motor Co., Ltd.', 'Bridgestone Corporation'),
('Honda Motor Co., Ltd.', 'Gentest Corporation'), ('Honda Motor Co., Ltd.',
'Denso Corporation']])
```

```
[ ]: plt.figure(figsize=(20,10))
nx.draw_networkx(us_graph)
plt.title('Figure 1. network visualization of the companies')
plt.show()
```

Figure 1. network visualization of the companies



```
[ ]: from networkx.algorithms.community centrality import girvan_newman
```

```
G = us_graph
communities = girvan_newman(G)

node_groups = []
for com in next(communities):
    node_groups.append(list(com))

color_map = []
for node in G:
    if node in node_groups[0]:
        color_map.append('blue')
    elif node in node_groups[1]:
        color_map.append('yellow')
    else:
        color_map.append('red')

plt.figure(figsize=(10,10))
nx.draw(G, node_color=color_map, with_labels=True)
plt.title('Figure 2. girvan_newman community detection')
plt.show()
```

[illegible]

(My findings)

5

centrality means the company has more connections from other companies. For the dataset of **edgelist** it can be seen that top 3 best connected company was : **Hyundai Motor Company (0.05778894472361809)**, **Honda Motor Co., Ltd. (0.035175879396984924)**, **Toyota Jidosha Kabushiki Kaisha (0.035175879396984924)**. It suggests Honda motor Co. have the 2nd highest degree centrality which means they have the 2nd highest connections to other companies

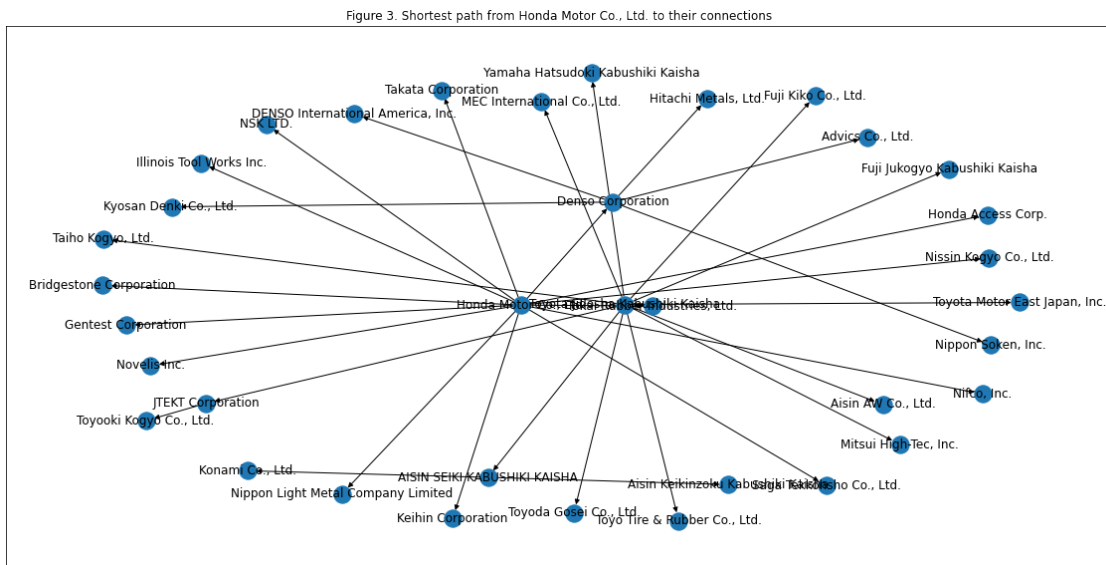
2. **Eigenvector centrality** measures a node's importance while giving consideration to the importance of its neighbors. Like degree centrality, EigenCentrality measures a node's influence based on the number of links it has to other nodes in the network. EigenCentrality then goes a step further by also taking into account how well connected a node is, and how many links their connections have, and so on through the network. **Hyundai Motor Company (0.626896526062543)**, **Kia Motors Corporation (0.32492094129267035)**, and **Kia Motors Corp. (0.21335170123268477)** had the eigenvector centrality which indicates that they are the most important companies in the network. **Honda Motor Co., Ltd.** had a Eigenvector centrality score of **0.00010179460908904** which is relatively lower than other companies of the dataset. That means **Honda Motor Co. Ltd** is not one of the most influential company. It can be seen that the ranking of companies based on Degree of centrality and eigenvector centrality is not similar in terms of **Honda Motor Co., Ltd.** . Which means **Honda Motor Co., Ltd.** is a well connected company but not the most important company in the dataset.
3. **Betweenness Centrality** is a measure of centrality in a graph based on shortest paths. it is a way of detecting the amount of influence a company has over the flow of information in a network. It is often used to find company that serve as a bridge from one part of a network to another. it calculates unweighted shortest paths between all pairs of company in a network. Each node receives a score, based on the number of shortest paths that pass through the node. Companies that more frequently lie on shortest paths between other companies will have higher betweenness centrality scores. In our dataset **Toyota Jidosha Kabushiki Kaisha (0.005025125628140704)**, **Honda Motor Co. Ltd. (0.004379580522258649)**, **Hyundai Motor Company (0.0030441881953849853)** had the highest betweenness score and they are the ones who influence the flow of information around the network. They are the ones whose removal from the network will most disrupt communications between other companies because they are the top connected companies. **Nippon Soken Inc. (0.13445378151260506)**, **AISIN SEIKI KABUSHIKI KAISHA (0.11260504201680673)** and **JTEKT Corporation (0.05714285714285715)** also had a good betweenness score. And the rest of the companies has 0 betweenness score. **Honda Motor Co. Ltd** is has the 2nd most influence over the network. It's obvious cause the company has a higher degree of centrality which indicates it's one of most well connected company as a result the betweenness centrality score should be also high.
4. **Closeness centrality** indicates how close a company is to all other companies in the network. It captures the average distance between each company and every other companies in the network. If information needed to flow through the network, some company would be able to get a message to all the other companies relatively quickly (i.e., in few steps), whereas others may require many steps. Top 4 closely centered Companies were : **Hyundai Motor Company (0.0578894472361809)**, **Toyota Jidosha Kabushiki Kaisha (0.04274846454494696)**, and **Honda Motor Co. Ltd. (0.041593100638326774)**. So, these companies with high closeness centrality is literally close to other companies. Company

nies with high closeness have, on average, short paths to many other companies, which can be helpful for disseminating resources quickly.

```
[ ]: # What is the shortest connection between Denso Corporation. and Toyota Jidosha
↳Kabushiki Kaisha
nx.shortest_path(us_graph,"Honda Motor Co., Ltd.,"Denso Corporation")
```

```
[ ]: ['Honda Motor Co., Ltd.', 'Denso Corporation']
```

```
[ ]: group1 = nx.bfs_tree(us_graph,"Honda Motor Co., Ltd.", "")
plt.figure(figsize=(20,10))
nx.draw_networkx(group1)
plt.title('Figure 3. Shortest path from Honda Motor Co., Ltd. to their
↳connections ')
plt.show()
```



```
[ ]: df = final_attribute
print(df.shape)
df.tail()
```

```
(35, 10)
```

```
[ ]:
```

| | ID | Patent_industry | ... | R&D_2012 | Country_code |
|----|------------------------------|-----------------|-----|----------|--------------|
| 30 | Toyo Tire & Rubber Co. Ltd. | 5 | ... | 71762.0 | 4.0 |
| 31 | Hitachi Metals Ltd. | 5 | ... | 117642.0 | 4.0 |
| 32 | Takata Corporation | 5 | ... | 207669.0 | 4.0 |
| 33 | Illinois Tool Works Inc. | 5 | ... | NaN | 1.0 |
| 34 | Tokai Rubber Industries Ltd. | 5 | ... | 103006.0 | 4.0 |

[5 rows x 10 columns]

```
[ ]: total = df.isnull().sum().sort_values(ascending=False)
percent = ((df.isnull().sum()/df.isnull().count())*100).
        ↳sort_values(ascending=False)
missing_data = pd.concat([total, percent], axis=1, keys=['Total', 'Percent'])
missing_data
```

```
[ ]:
```

| | Total | Percent |
|-------------------|-------|-----------|
| R&D_2012 | 15 | 42.857143 |
| Turnover_2012 | 9 | 25.714286 |
| Total_assets_2012 | 9 | 25.714286 |
| Employees_2012 | 9 | 25.714286 |
| Turnover_lay | 4 | 11.428571 |
| Country_code | 3 | 8.571429 |
| ID | 0 | 0.000000 |
| Patent_industry | 0 | 0.000000 |
| University | 0 | 0.000000 |
| Patent_count | 0 | 0.000000 |

```
[ ]: df.describe()
```

```
[ ]:
```

| | Patent_industry | University | ... | R&D_2012 | Country_code |
|-------|-----------------|------------|-----|--------------|--------------|
| count | 35.0 | 35.0 | ... | 2.000000e+01 | 32.00000 |
| mean | 5.0 | 0.0 | ... | 1.284073e+06 | 3.90625 |
| std | 0.0 | 0.0 | ... | 2.335983e+06 | 0.53033 |
| min | 5.0 | 0.0 | ... | 3.294000e+03 | 1.00000 |
| 25% | 5.0 | 0.0 | ... | 6.232400e+04 | 4.00000 |
| 50% | 5.0 | 0.0 | ... | 2.487045e+05 | 4.00000 |
| 75% | 5.0 | 0.0 | ... | 8.432698e+05 | 4.00000 |
| max | 5.0 | 0.0 | ... | 8.576251e+06 | 4.00000 |

[8 rows x 9 columns]

```
[ ]: Honda_df = df[df['ID']=='Honda Motor Co. Ltd.']
```

```
Honda_df
```

```
[ ]:
```

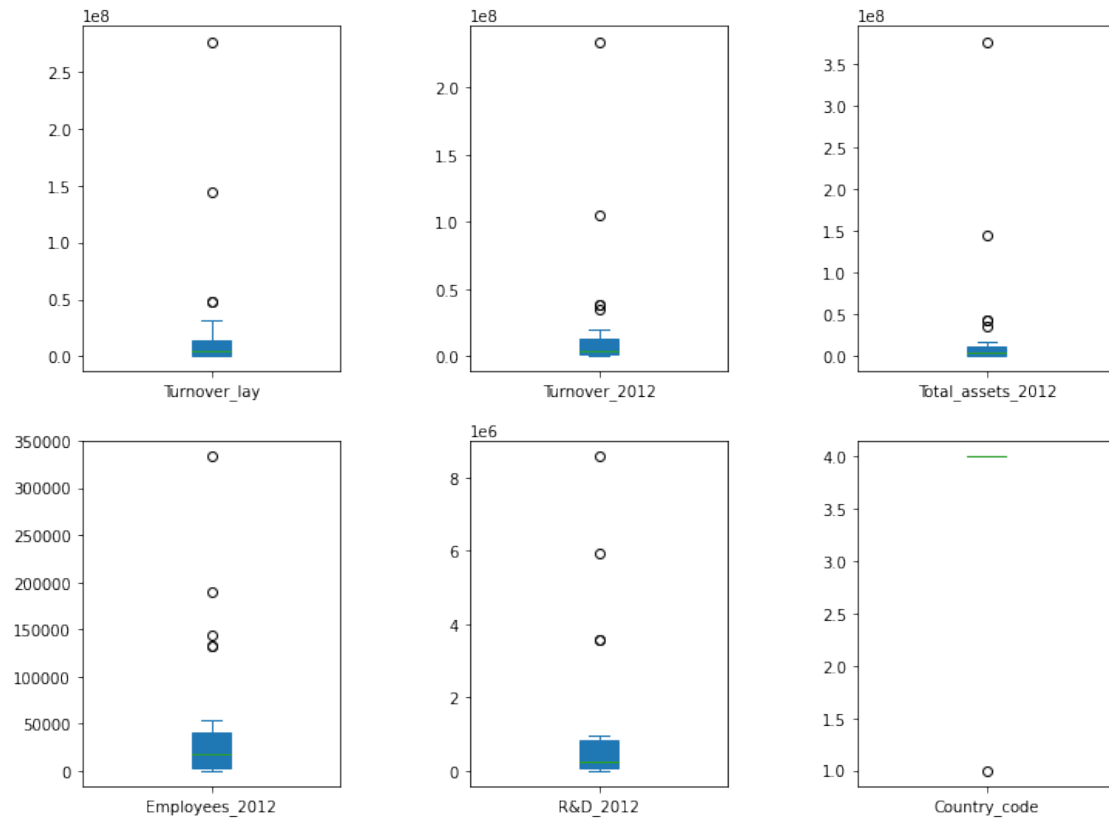
| | ID | Patent_industry | ... | R&D_2012 | Country_code |
|---|----------------------|-----------------|-----|-----------|--------------|
| 5 | Honda Motor Co. Ltd. | | 5 | 5950823.0 | 4.0 |

[1 rows x 10 columns]

```
[ ]: # select columns to plot
df_to_plot = final_attribute.drop(columns=['ID',
        ↳'Patent_industry', 'Patent_count', 'University' ]).select_dtypes(include=np.
        ↳number)
```



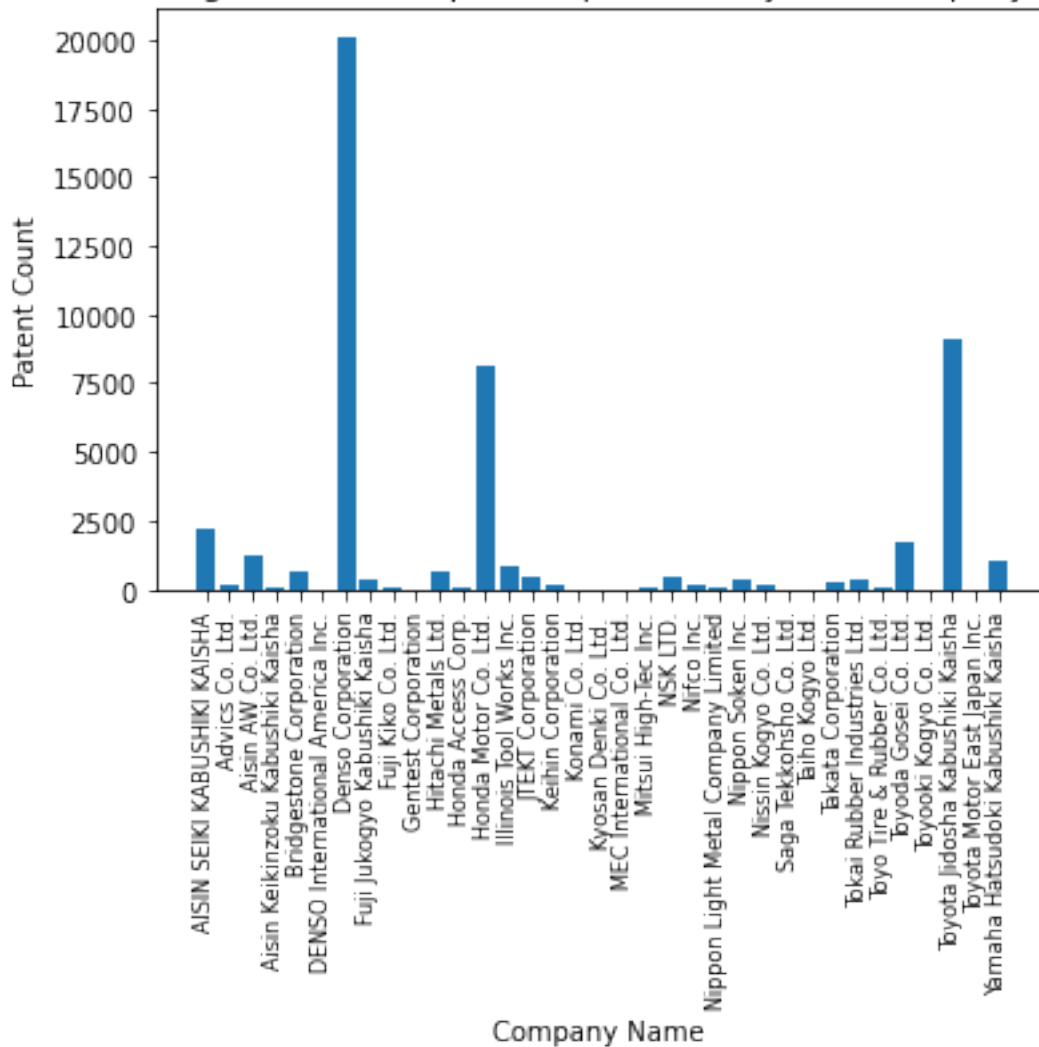
```
# subplots
df_to_plot.plot(subplots=True, layout=(3,3), kind='box', figsize=(12,14),
    patch_artist=True)
plt.subplots_adjust(wspace=0.5);
```



```
[ ]: keys = [company for company, df in df.groupby(['ID'])]

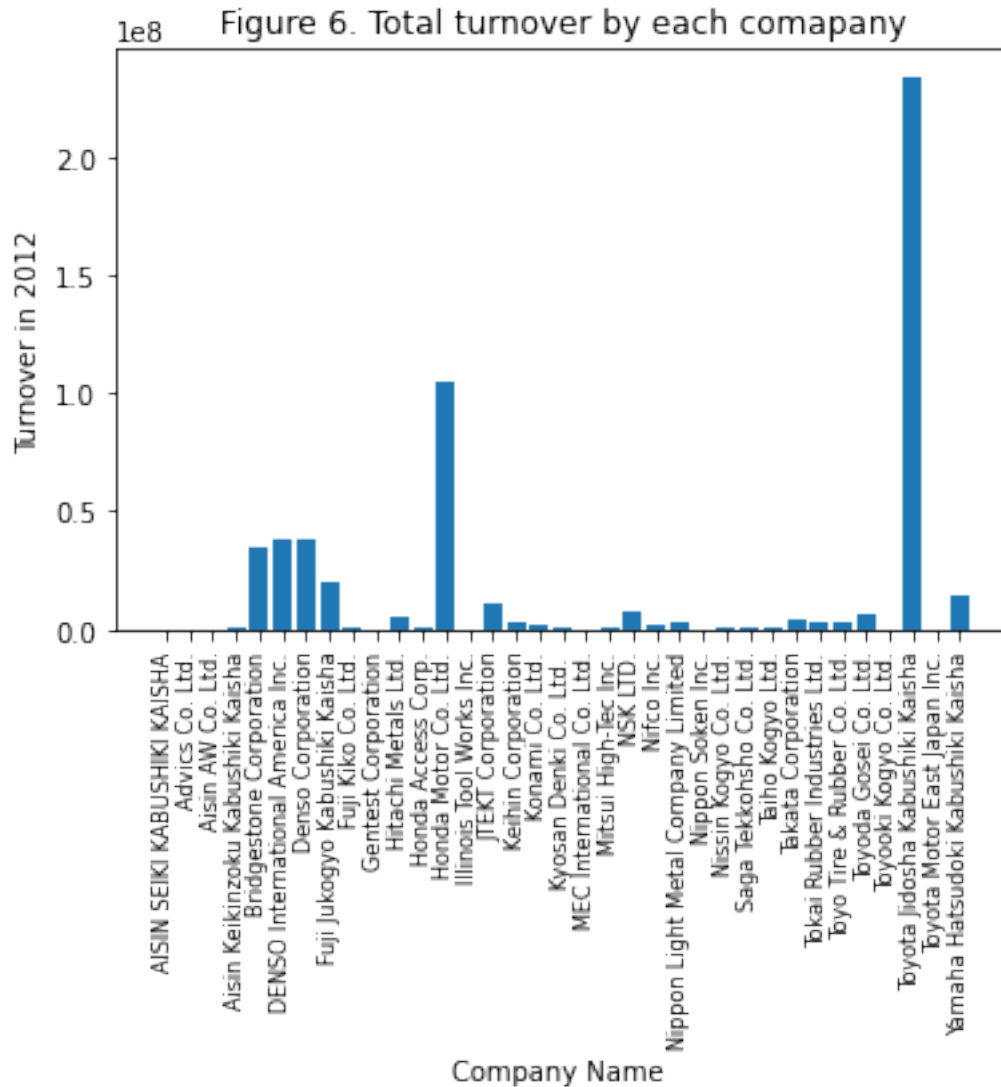
plt.bar(keys,df.groupby(['ID']).sum()['Patent_count'])
plt.ylabel('Patent Count')
plt.xlabel('Company Name ')
plt.xticks(keys, rotation='vertical', size=8)
plt.title('Figure 5. Sum of patents produced by each company')
plt.show()
```

Figure 5. Sum of patents produced by each company



```
[ ]: keys = [company for company, df in df.groupby(['ID'])]

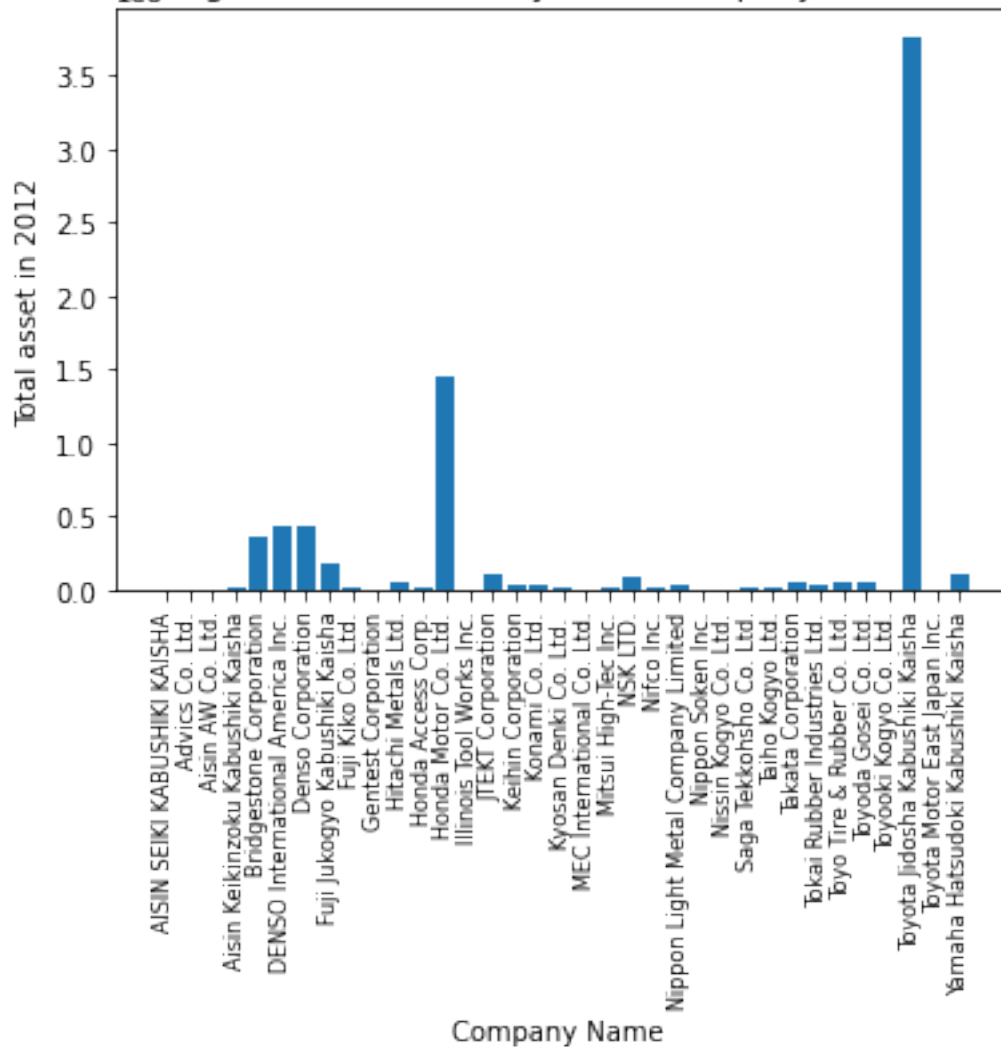
plt.bar(keys,df.groupby(['ID']).sum()['Turnover_2012'])
plt.ylabel('Turnover in 2012')
plt.xlabel('Company Name ')
plt.xticks(keys, rotation='vertical', size=8)
plt.title('Figure 6. Total turnover by each comapany')
plt.show()
```



```
[ ]: keys = [company for company, df in df.groupby(['ID'])]

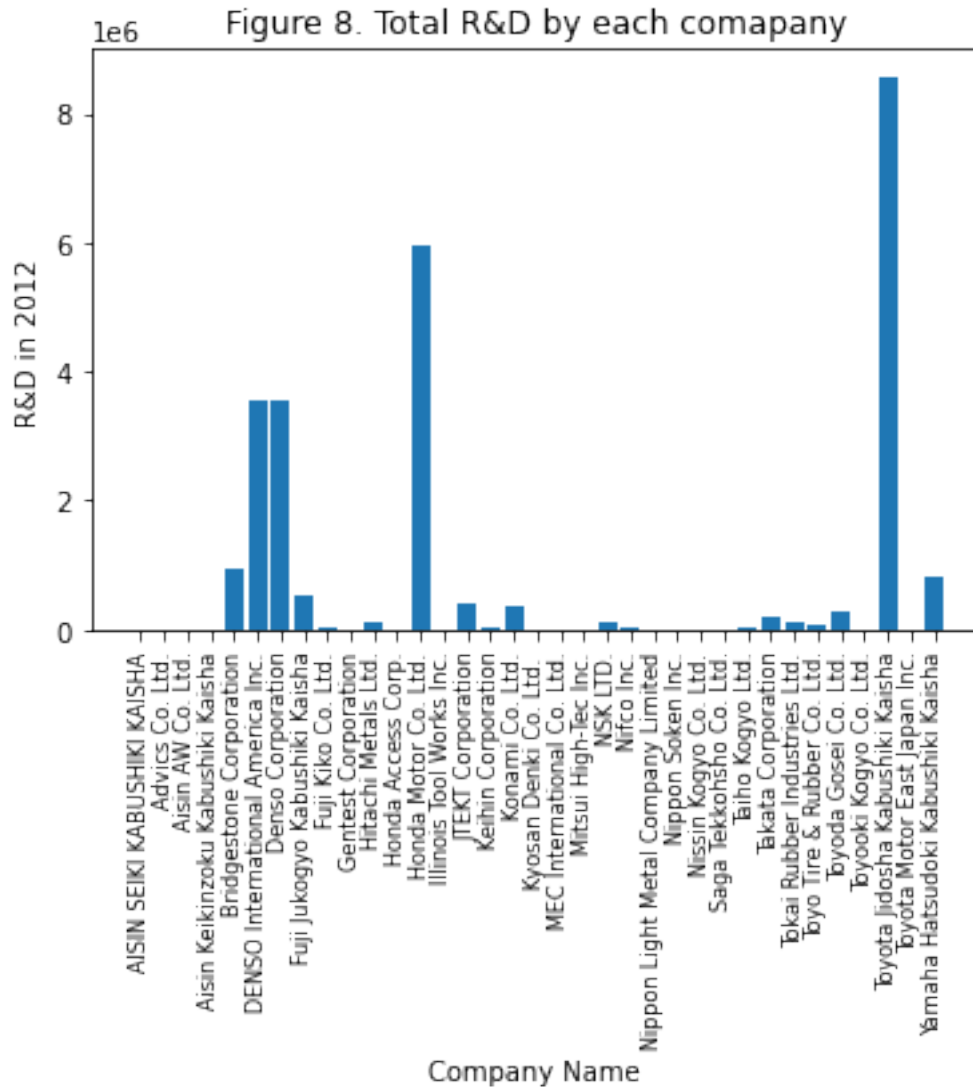
plt.bar(keys,df.groupby(['ID']).sum()['Total_assets_2012'])
plt.ylabel('Total asset in 2012')
plt.xlabel('Company Name ')
plt.xticks(keys, rotation='vertical', size=8)
plt.title('Figure 7. Total asset by each company in 2012')
plt.show()
```

1e8 Figure 7. Total asset by each comapany in 2012



```
[ ]: keys = [company for company, df in df.groupby(['ID'])]

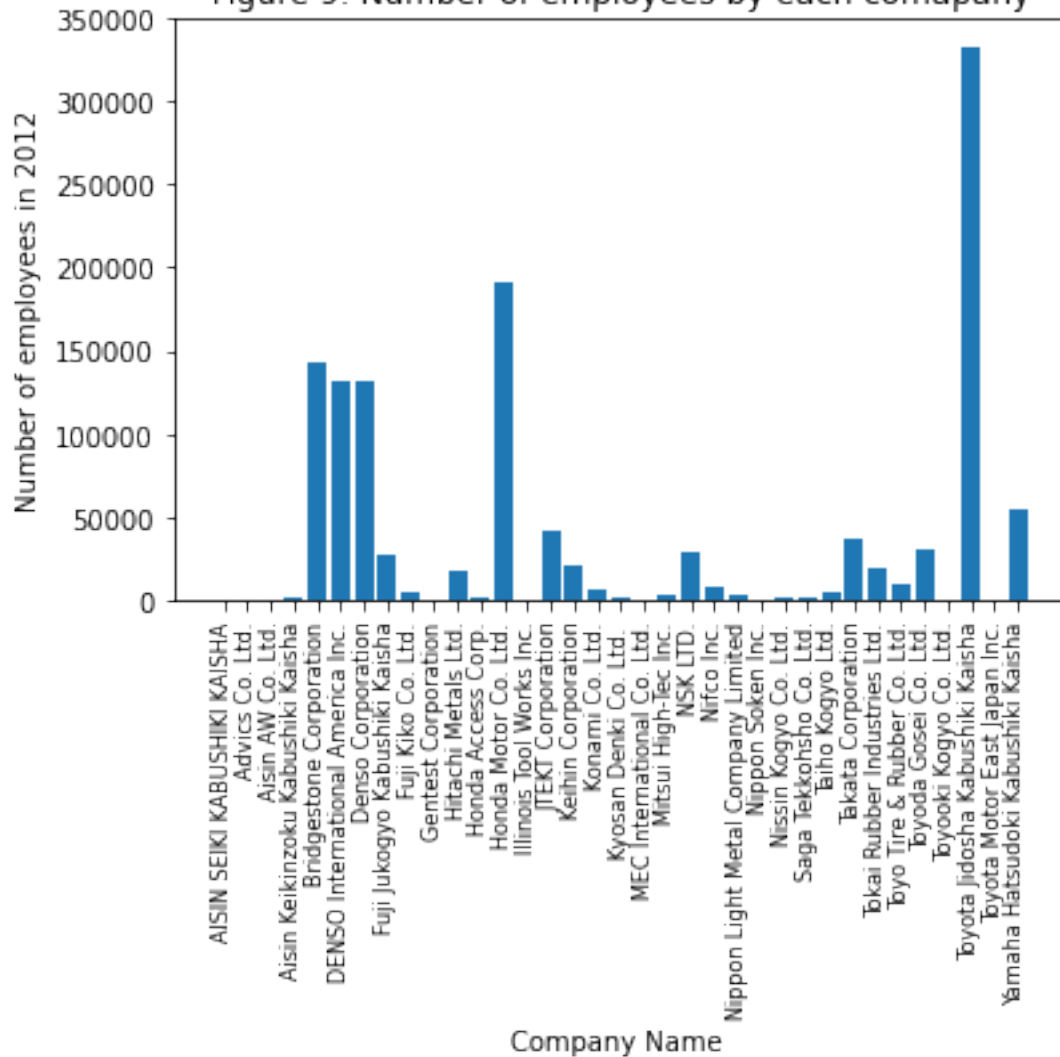
plt.bar(keys,df.groupby(['ID']).sum()['R&D_2012'])
plt.ylabel('R&D in 2012')
plt.xlabel('Company Name ')
plt.xticks(keys, rotation='vertical', size=8)
plt.title('Figure 8. Total R&D by each comapany')
plt.show()
```



```
[ ]: keys = [company for company, df in df.groupby(['ID'])]

plt.bar(keys,df.groupby(['ID']).sum()['Employees_2012'])
plt.ylabel('Number of employees in 2012')
plt.xlabel('Company Name ')
plt.xticks(keys, rotation='vertical', size=8)
plt.title('Figure 9. Number of employees by each company')
plt.show()
```

Figure 9. Number of employees by each company



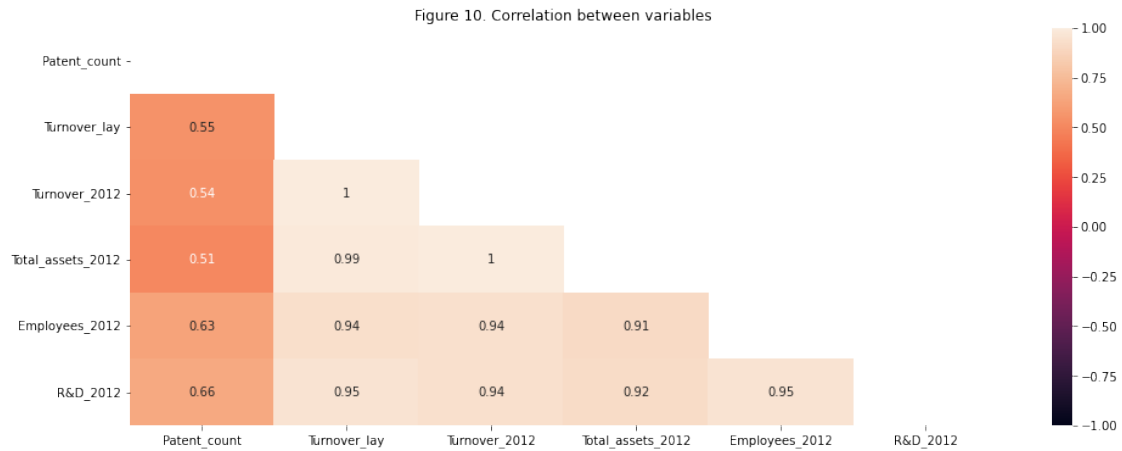
```
[ ]: df.columns
```

```
[ ]: Index(['ID', 'Patent_industry', 'University', 'Patent_count', 'Turnover_lay',
          'Turnover_2012', 'Total_assets_2012', 'Employees_2012', 'R&D_2012',
          'Country_code'],
         dtype='object')
```

```
[ ]: data = df[['Patent_count', 'Turnover_lay', 'Turnover_2012', 'Total_assets_2012',
               ↪ 'Employees_2012', 'R&D_2012']]
plt.figure(figsize=(16, 6))
corr = data.corr()
mask = np.triu(np.ones_like(corr, dtype=bool))
heatmap = sns.heatmap(data.corr(), mask=mask, vmin=-1, vmax=1, annot=True)
```

```
heatmap.set_title('Correlation Heatmap', fontdict={'fontsize':12}, pad=12);
plt.title('Figure 10. Correlation between variables')

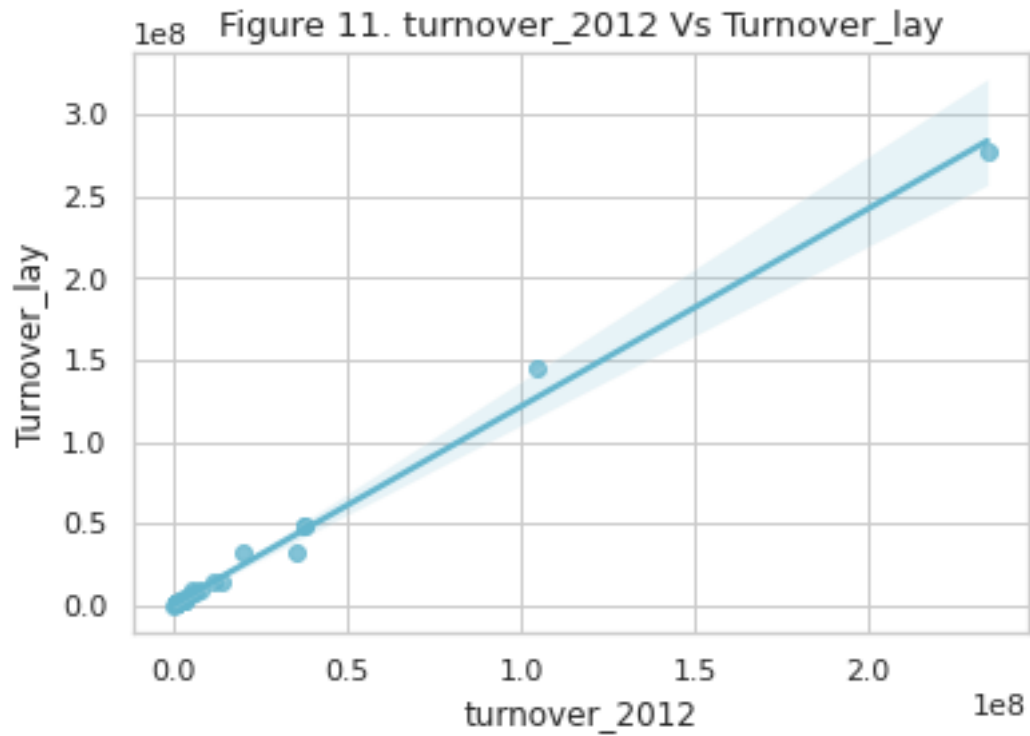
plt.show()
```



```
[ ]: ax = sns.regplot(x=df['Turnover_2012'],y=df['Turnover_lay'],color='c')

#setup the title and the labels of the scatter plot.
ax.set_title("Figure 11. turnover_2012 Vs Turnover_lay",fontsize=13)
ax.set_xlabel("turnover_2012",fontsize=12)
ax.set_ylabel("Turnover_lay",fontsize=12)

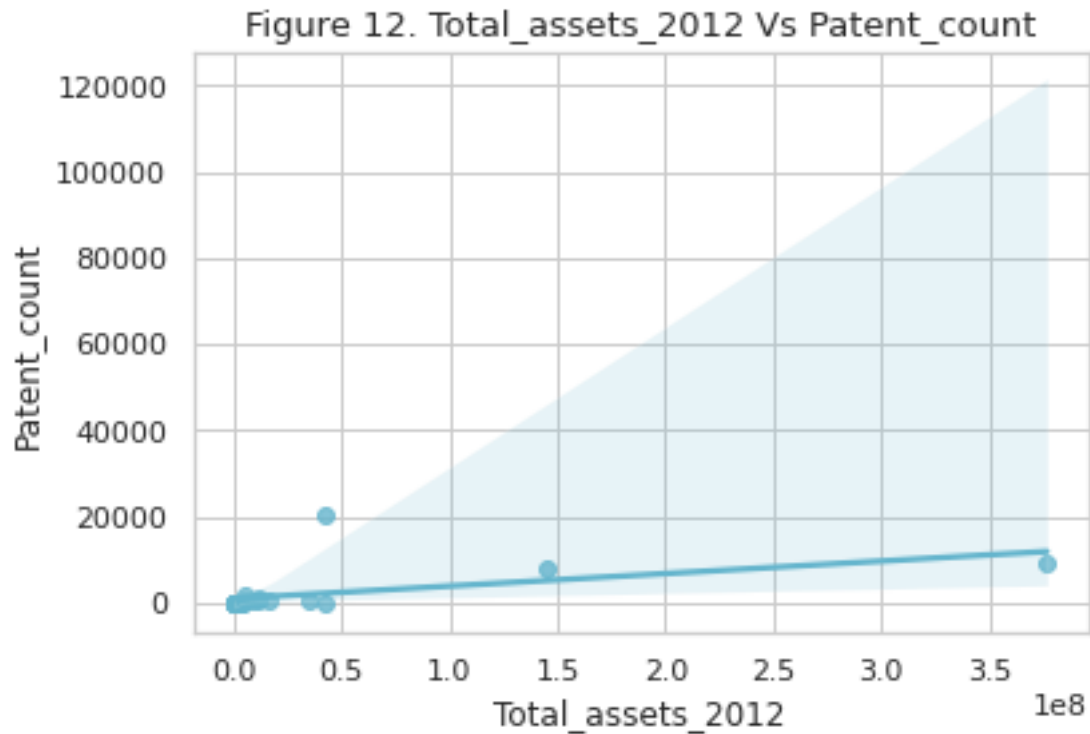
#setup the figure size.
sns.set(rc={'figure.figsize':(6,4)})
sns.set_style("whitegrid")
```

```
[ ]: ax = sns.regplot(x=df['Total_assets_2012'],y=df['Patent_count'],color='c')

#setup the title and the labels of the scatter plot.
ax.set_title("Figure 12. Total_assets_2012 Vs Patent_count",fontsize=13)
ax.set_xlabel("Total_assets_2012",fontsize=12)
ax.set_ylabel("Patent_count",fontsize=12)

#setup the figure size.
sns.set(rc={'figure.figsize':(6,4)})
sns.set_style("whitegrid")
```



0.5 Discuss the implication of industry and country environments on the innovation strategy of the firm (400 words)

[]:

[]:

Appendix

```
[ ]: # degree centrality
most_influential = nx.degree_centrality(us_graph)
for w in sorted(most_influential, key=most_influential.get, reverse=True):
    print(w, most_influential[w])
```

```
Hyundai Motor Company 0.05778894472361809
Honda Motor Co., Ltd. 0.035175879396984924
Toyota Jidosha Kabushiki Kaisha 0.035175879396984924
Kia Motors Corporation 0.022613065326633167
GM Global Technology Operations, Inc. 0.020100502512562814
Denso Corporation 0.01507537688442211
Kia Motors Corp. 0.01256281407035176
Centre National de la Recherche Scientifique (CNRS) 0.01256281407035176
Hon Hai Precision Industry Co., Ltd. 0.01256281407035176
```

Airbus Helicopters 0.01256281407035176
 Nissan Motor Co., Ltd. 0.01256281407035176
 AISIN SEIKI KABUSHIKI KAISHA 0.010050251256281407
 Chrysler Group LLC 0.010050251256281407
 NIPPON STEEL & SUMITOMO METAL CORPORATION 0.010050251256281407
 Airbus Helicopters Deutschland GmbH 0.010050251256281407
 Kabushiki Kaisha Toshiba 0.010050251256281407
 CPE Lyon 0.007537688442211055
 UNIVERSITE CLAUDE BERNARD LYON I 0.007537688442211055
 CNRS-Centre National de la Recherche Scientifique 0.007537688442211055
 COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
 0.007537688442211055
 Samsung Electronics Co., Ltd. 0.007537688442211055
 Thales 0.007537688442211055
 Centre National d'Etudes Spatiales 0.007537688442211055
 UNIVERSITE D 'AIX-MARSEILLE 0.007537688442211055
 JTEKT Corporation 0.007537688442211055
 Daimler-Benz AG 0.007537688442211055
 Bayerische Motoren Werke Aktiengesellschaft 0.007537688442211055
 Pyeong Hwa Valeo CO., LTD. 0.007537688442211055
 Myocogen Corporation 0.007537688442211055
 Keyang Electric Machinery Co., Ltd. 0.007537688442211055
 Fischer + Entwicklungen GmbH & Co KG 0.007537688442211055
 Schroth Safety Products GmbH 0.007537688442211055
 Sumitomo Electric Industries, Ltd. 0.007537688442211055
 Kokichi Terajima 0.007537688442211055
 Xinhongzhou Precision Technology Co., Ltd 0.007537688442211055
 Micro Win Tech Inc. 0.007537688442211055
 LARGAN PRECISION CO., LTD. 0.007537688442211055
 Toyota Motor Engineering & Manufacturing North America, Inc.
 0.007537688442211055
 Hyundai Motor Japan R&D Center 0.005025125628140704
 Canon Kabushiki Kaisha 0.005025125628140704
 The Arizona Board of Regents on behalf of the University of Arizona
 0.005025125628140704
 Nippon Light Metal Company Limited 0.005025125628140704
 Novelis Inc. 0.005025125628140704
 Autoliv Development AB 0.005025125628140704
 Motex Products Co., Ltd. 0.005025125628140704
 Industry-Univ. Cooperation Foundation of Korea Aerospace Univ.
 0.005025125628140704
 Kookmin Univ. Industry Academy Cooperation Foundation 0.005025125628140704
 BOE TECHNOLOGY GROUP CO., LTD. 0.005025125628140704
 The Furukawa Electric Co., Ltd. 0.005025125628140704
 Massachusetts Institute of Technology 0.005025125628140704
 National Institute of Information and Communications Technology
 0.005025125628140704
 Seohan Industry Co., Ltd. 0.005025125628140704

Fujigiken Co., Ltd. 0.005025125628140704
 WEST NIPPON EXPRESSWAT COMPANY, LIMITED 0.005025125628140704
 Fuji Engineering Co., Ltd. 0.005025125628140704
 Nippon Soken, Inc. 0.005025125628140704
 Fuji Kiko Co., Ltd. 0.005025125628140704
 Aisin AW Co., Ltd. 0.005025125628140704
 Tokai Rubber Industries, Ltd. 0.005025125628140704
 Fujitsu Limited 0.005025125628140704
 NOK Corporation 0.005025125628140704
 National Institute for Materials Science 0.005025125628140704
 Cal-Comp Electronics & Communications Company Limited 0.005025125628140704
 CITIZEN HOLDINGS CO., LTD. 0.005025125628140704
 Crane & Co., Inc. 0.005025125628140704
 Crane AB 0.005025125628140704
 Visual Physics, LLC 0.005025125628140704
 SAE Magnetics (H.K.) Ltd. 0.005025125628140704
 Board of Regents, University of Texas System 0.005025125628140704
 DONG HEE INDUSTRIAL CO., LTD. 0.005025125628140704
 HAAN Corporation 0.005025125628140704
 DAE WON KANG UP CO., LTD. 0.005025125628140704
 MITSUBISHI MATERIALS CORPORATION 0.005025125628140704
 Hyundai Motor Europe Technical Center GmbH 0.005025125628140704
 Delta Electronics Inc. 0.005025125628140704
 Korea Advanced Institue of Science & Technology 0.005025125628140704
 Yong San Co., Ltd. 0.005025125628140704
 Samshin Precision Co., Ltd. 0.005025125628140704
 Kavlico Corporation 0.005025125628140704
 TOSHIBA TEC KABUSHIKI KAISHA 0.005025125628140704
 The Japan Steel Works, Ltd. 0.005025125628140704
 United Technologies Corporation 0.005025125628140704
 Tesla Motors, Inc. 0.005025125628140704
 Mazda Motor Corporation 0.005025125628140704
 Nishikawa Rubber Co., Ltd. 0.005025125628140704
 Kinki University 0.005025125628140704
 Osaka Prefecture University Public Corporation 0.005025125628140704
 ILB Co., Ltd. 0.005025125628140704
 ColorMatrix Group, Inc. 0.002512562814070352
 Reduction Engineering, Inc. 0.002512562814070352
 Alps Electric Co., Ltd. 0.002512562814070352
 Orion Engineered Carbons GbmH 0.002512562814070352
 New Jersey Institute of Technology 0.002512562814070352
 RFCyber Corp. 0.002512562814070352
 Rich House Global Technology Ltd. 0.002512562814070352
 MARUISHI SANYO CO., LTD 0.002512562814070352
 Kuraray Co., Ltd. 0.002512562814070352
 BEIJING BOE DISPLAY TECHNOLOGY CO., LTD. 0.002512562814070352
 Federal State Budgetary Institution "Federal Agency for Legal Protection of
 Military, Special and Dual Use Intellectual Activity Results" (FSBI "FALPIAR")

0.002512562814070352
 Zakritoe Aktzionerno Obschestvo 'TSENTR' 'VOSPI' (VOSPI Center CJSC (Closed
 Stock Company)) 0.002512562814070352
 Volex PLC 0.002512562814070352
 Applied Micro Circuits Corporation 0.002512562814070352
 Vestas Wind Systems A/S 0.002512562814070352
 ZF Friedrichshafen AG 0.002512562814070352
 Fujitsu Optical Components Limited 0.002512562814070352
 FURUKAWA AUTOMOTIVE SYSTEMS INC. 0.002512562814070352
 Polytech Kagawa, Co., Ltd. 0.002512562814070352
 Institute of National Colleges of Technology, Japan 0.002512562814070352
 The Trustees of Boston College 0.002512562814070352
 OPTOQUEST CO., LTD. 0.002512562814070352
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 FIH (Hong Kong) Limited 0.002512562814070352
 Industry-University Cooperation Foundation Korea Aerospace University
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 THE UNIVERSITY OF CONNECTICUT 0.002512562814070352
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 American Audio Components Inc. 0.002512562814070352

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[ ]: # eigenvector centrality
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for w in sorted(most_important_link, key=most_important_link.get, reverse=True):
    print(w, most_important_link[w])
  
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 TOSHIBA MATERIALS CO., LTD. 1.0473852804836129e-11
 Toshiba Consumer Electronics Holdings Corporation 1.0473852804836129e-11
 NCR Corporation 6.2809224634837864e-12
 YACHIYO INDUSTRIAL CO., LTD. 6.2809224634837864e-12
 NIPPON STEEL & SUMITOMO METAL CORPORATION 5.3275783206193884e-12
 Motex Products Co., Ltd. 3.55171888041292e-12
 Industry-Univ. Cooperation Foundation of Korea Aerospace Univ.
 3.55171888041292e-12
 Kookmin Univ. Industry Academy Cooperation Foundation 3.55171888041292e-12
 Fujigiken Co., Ltd. 3.55171888041292e-12
 WEST NIPPON EXPRESSWAT COMPANY, LIMITED 3.55171888041292e-12
 Fuji Engineering Co., Ltd. 3.55171888041292e-12
 Crane & Co., Inc. 3.55171888041292e-12
 Crane AB 3.55171888041292e-12
 Visual Physics, LLC 3.55171888041292e-12
 Kinki University 3.55171888041292e-12
 Osaka Prefecture University Public Corporation 3.55171888041292e-12
 ILB Co., Ltd. 3.55171888041292e-12
 Sumitomo Pipe & Tube Co., Ltd. 2.663789160309691e-12
 Mitsubishi-Hitachi Metals Machinery, Inc. 2.663789160309691e-12
 Uniphase Corporation 2.663789160309691e-12
 TOYODA IRON WORKS CO., LTD. 2.663789160309691e-12
 Toyota Motor Engineering & Manufacturing North America, Inc.
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 Tesla Motors, Inc. 2.1614480412826924e-12
 Nishikawa Rubber Co., Ltd. 1.7655189388405045e-12
 Mazda Motor Corporation 1.2489082203730222e-12
 Toyota Motor Corporation 1.2474148038926839e-12
 Toyoda Gosei North America Corporation 1.2474148038926839e-12
 DaikyoNishikawa Corporation 6.46671103790689e-13
 Samsung Electronics Co., Ltd. 2.668642407386946e-13
 Sumitomo Electric Industries, Ltd. 2.668642407386946e-13
 Georgia Tech Research Corp. 1.5407414122757044e-13
 Chungbuk National University Industry Academic Cooperation Foundation
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 Kumoh National Institute of Technology Industry-Academic Cooperation Foundation
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 Sumitomo Electric Hardmetal Corp. 1.5407414122757044e-13
 Sumitomo (SEI) Steel Wire Corp. 1.5407414122757044e-13
 Sumitomo Electric Toyama Co., Ltd. 1.5407414122757044e-13
 Canon Kabushiki Kaisha 6.10103703729768e-14
 The Arizona Board of Regents on behalf of the University of Arizona
 6.10103703729768e-14
 Massachusetts Institute of Technology 6.10103703729768e-14
 NOK Corporation 6.10103703729768e-14
 National Institute for Materials Science 6.10103703729768e-14
 Board of Regents, University of Texas System 6.10103703729768e-14

Alps Electric Co., Ltd. 3.7706482556719266e-14
 The Trustees of Boston College 3.7706482556719266e-14
 Nikon Engineering Co., Ltd. 3.7706482556719266e-14
 FUJIKURA LTD. 3.7706482556719254e-14
 The University of Kansas 3.7706482556719254e-14
 The President and Fellows of Harvard College 3.7706482556719254e-14
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 The Furukawa Electric Co., Ltd. 5.098842801441917e-15
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 BEIJING BOE DISPLAY TECHNOLOGY CO., LTD. 3.605426321103794e-15
 Fujitsu Optical Components Limited 3.605426321103794e-15
 FURUKAWA AUTOMOTIVE SYSTEMS INC. 3.605426321103794e-15
 OPTOQUEST CO., LTD. 3.605426321103794e-15
 Fujitsu Ten Limited 3.605426321103794e-15
 Cal-Comp Precision (Singapore) Limited 3.605426321103794e-15
 Citizen Machinery Co., Ltd 3.605426321103794e-15
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 Headway Technologies, Inc. 3.605426321103794e-15
 CTA Technology (Proprietary) Limited 3.605426321103794e-15
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 Fujitsu Telecom Networks Limited 3.605426321103794e-15
 TDK Corporation 3.605426321103794e-15
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 THE OHIO STATE UNIVERSITY 3.605426321103794e-15
 MTU Aero Engines GmbH 3.605426321103794e-15
 Stanley Electric Co., Ltd. 3.605426321103794e-15
 Delta Electronics (Shanghai) Co., Ltd. 3.605426321103794e-15
 ColorMatrix Group, Inc. 1.2348367703493153e-17
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 Orion Engineered Carbons GbmH 1.2348367703493153e-17
 New Jersey Institute of Technology 1.2348367703493153e-17
 RFCyber Corp. 1.2348367703493153e-17
 Rich House Global Technology Ltd. 1.2348367703493153e-17
 MARUISHI SANYO CO., LTD 1.2348367703493153e-17
 Kuraray Co., Ltd. 1.2348367703493153e-17
 Federal State Budgetary Institution "Federal Agency for Legal Protection of
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Zakritoe Aktzionernoe Obschestvo 'TSENTR' 'VOSPI' (VOSPI Center CJSC (Closed
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 Shanghai Maple Guorun Automobile Co 1.2348367703493153e-17
 Zhejiang Geely Holding Group Co., Ltd 1.2348367703493153e-17
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 Clark Equipment Company 1.2348367703493153e-17
 Centre Luxembourgeois de Recherches pour le Verre et la Ceramique S.A.
 (C.R.V.C.) 1.2348367703493153e-17
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 Nakanishi Metal Works Co., Ltd. 1.2348367703493153e-17
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 Cooper Industries, Inc. 1.2348367703493153e-17
 Kobe Steel, Limited 1.2348367703493153e-17
 Kobelco Construction Machinery Co., Ltd. 1.2348367703493153e-17
 AAC Acoustic Technologies (Shenzhen) Co., Ltd. 1.2348367703493153e-17
 American Audio Components Inc. 1.2348367703493153e-17

```

[ ]: # betweenness centrality
best_connector = nx.betweenness_centrality(us_graph)
for w in sorted(best_connector, key=best_connector.get, reverse=True):
    print(w, best_connector[w])
  
```

Toyota Jidosha Kabushiki Kaisha 0.005025125628140704
 Honda Motor Co., Ltd. 0.004379580522258649
 Hyundai Motor Company 0.0030441881953849853
 Tokai Rubber Industries, Ltd. 0.0026328114122248524
 Denso Corporation 0.001810057845904586
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 AISIN SEIKI KABUSHIKI KAISHA 0.0008480690606685823
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Centre National de la Recherche Scientifique (CNRS) 8.86042302191056e-05
 NIPPON STEEL & SUMITOMO METAL CORPORATION 7.594648304494766e-05
 Airbus Helicopters Deutschland GmbH 6.328873587078973e-05
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 Canon Kabushiki Kaisha 2.5315494348315888e-05
 The Arizona Board of Regents on behalf of the University of Arizona
 2.5315494348315888e-05
 Massachusetts Institute of Technology 2.5315494348315888e-05
 NOK Corporation 2.5315494348315888e-05
 National Institute for Materials Science 2.5315494348315888e-05
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 National Institute of Information and Communications Technology
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 MITSUBISHI MATERIALS CORPORATION 1.2657747174157944e-05
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 Hyundai Motor Japan R&D Center 0.0
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 Industry-Univ. Cooperation Foundation of Korea Aerospace Univ. 0.0
 Kookmin Univ. Industry Academy Cooperation Foundation 0.0
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 CPE Lyon 0.0
 UNIVERSITE CLAUDE BERNARD LYON I 0.0
 CNRS-Centre National de la Recherche Scientifique 0.0
 COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES 0.0

Federal State Budgetary Institution "Federal Agency for Legal Protection of
 Military, Special and Dual Use Intellectual Activity Results" (FSBI "FALPIAR")
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 Zakritoe Aktzionernoe Obschestvo 'TSENTR' 'VOSPI' (VOSPI Center CJSC (Closed
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 Volex PLC 0.0
 Applied Micro Circuits Corporation 0.0
 Vestas Wind Systems A/S 0.0
 ZF Friedrichshafen AG 0.0
 Fujitsu Optical Components Limited 0.0
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 The Trustees of Boston College 0.0
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 SHIMANO INC. 0.0
 King Slide Works Co., Ltd. 0.0
 King Slide Technology Co., Ltd. 0.0
 Tokyo Institute of Technology 0.0
 Tokyo Medical and Dental University 0.0
 IXFIBER 0.0
 Thales 0.0
 Centre National d'Etudes Spatiales 0.0
 UNIVERSITE PIERRE ET MARIE CURIE (PARIS 6) 0.0
 UNIVERSITE D 'AIX-MARSEILLE 0.0
 Fujigiken Co., Ltd. 0.0
 WEST NIPPON EXPRESSWAT COMPANY, LIMITED 0.0
 Fuji Engineering Co., Ltd. 0.0
 SAGE ELECTROCHROMICS, INC. 0.0
 Alliance for Sustainable Energy, LLC 0.0
 Shenzhen Futaihong Precision Industry Co., Ltd. 0.0
 FIH (Hong Kong) Limited 0.0
 Industry-University Cooperation Foundation Korea Aerospace University 0.0
 KOOKMIN UNIVERSITY INDUSTRY ACADEMY COOPERATION FOUNDATION 0.0
 Shanghai Maple Guorun Automobile Co 0.0

Zhejiang Geely Holding Group Co., Ltd 0.0
 MEC International Co., Ltd. 0.0
 Fuji Jukogyo Kabushiki Kaisha 0.0
 Toyo Tire & Rubber Co., Ltd. 0.0
 Toyoda Gosei Co., Ltd. 0.0
 Yamaha Hatsudoki Kabushiki Kaisha 0.0
 Toyota Motor East Japan, Inc. 0.0
 Fuji Kiko Co., Ltd. 0.0
 Aisin AW Co., Ltd. 0.0
 Taiho Kogyo, Ltd. 0.0
 Mitsui High-Tec, Inc. 0.0
 THE UNIVERSITY OF CONNECTICUT 0.0
 Otis Elevator Company 0.0
 Fujitsu Ten Limited 0.0
 Nikon Engineering Co., Ltd. 0.0
 Cal-Comp Precision (Singapore) Limited 0.0
 Peugeot Citroen Automobiles SA 0.0
 Wisconsin Alumni Research Foundation 0.0
 Daimler-Benz AG 0.0
 Université Laval 0.0
 The United States of America as represented by the Administrator of the National
 Aeronautics and Space Administration 0.0
 Bayerische Motoren Werke Aktiengesellschaft 0.0
 Kao Corporation 0.0
 Citizen Machinery Co., Ltd 0.0
 Citizen Systems Japan Co., Ltd. 0.0
 Carib Design Service Inc. 0.0
 Mamiya-Op Co., Ltd. 0.0
 Danfoss Low Power Drives 0.0
 Pentair Water Pool and Spa, Inc. 0.0
 Curators of the University of Missouri 0.0
 Regency Technologies LLC 0.0
 Crane & Co., Inc. 0.0
 Crane AB 0.0
 Visual Physics, LLC 0.0
 Shin-Etsu Quartz Products Co., Ltd. 0.0
 Opto-Electronics Laboratory, Inc. 0.0
 Golden Sun News Techniques Co., Ltd. 0.0
 Cpumate Inc. 0.0
 E. I. du Pont de Nemours and Company 0.0
 NANO TECHNICS COMPANY LTD 0.0
 Wincor Nixdorf International GmbH 0.0
 Crane Payment Solutions GmbH 0.0
 Fast & Fluid Management B.V. 0.0
 Starstatus Trading Internacional LDA 0.0
 Pyeong Hwa Valeo CO., LTD. 0.0
 Myocogen Corporation 0.0
 Keyang Electric Machinery Co., Ltd. 0.0

Nifco, Inc. 0.0
 Toppan Printing Co., Ltd. 0.0
 Hisamitsu Pharmaceutical Co., Ltd. 0.0
 LG CNS CO., LTD. 0.0
 Robotis Co., Ltd. 0.0
 FUJIKURA LTD. 0.0
 Sumitomo Pipe & Tube Co., Ltd. 0.0
 Saint-Gobain Abrasifs 0.0
 Saint-Gobain Abrasifs Technologie ET Services 0.0
 Hitachi Metals, Ltd. 0.0
 MAR Systems, Inc. 0.0
 Siémens Aktiengesellschaft 0.0
 Volkswagon AG 0.0
 Sicon GmbH 0.0
 Reynolds Systems, Inc. 0.0
 Alliant Techsystems, Inc. 0.0
 ZTE (USA) Inc. 0.0
 ZTE Corporation 0.0
 Zhong Da National Engineering and Research Center of Continuous Casting
 Technology Co. Ltd. 0.0
 CENTRAL IRON AND STEEL RESEARCH INSTITUTE 0.0
 Faurecia Interieur Industrie 0.0
 Faurecia Innenraum Systeme GmbH 0.0
 Mitsubishi-Hitachi Metals Machinery, Inc. 0.0
 Headway Technologies, Inc. 0.0
 The University of Kansas 0.0
 Michelin Recherche et Technique S.A. 0.0
 Compagnie Generale des Etablissements Michelin 0.0
 Optical Logic Inc. 0.0
 KANTATSU CO., LTD. 0.0
 Rolls-Royce Corporation 0.0
 Rolls-Royce North American Technologies Inc. 0.0
 Keihin Corporation 0.0
 Premier Image Technology(China) Ltd. 0.0
 EADS (European Aeronautic Defence And Space Company EADS France) 0.0
 Fischer + Entwicklungen GmbH & Co KG 0.0
 Schroth Safety Products GmbH 0.0
 Ecole Naitonale Supérieure d'Arts et Métiers-E.N.S.A.M 0.0
 DONG HEE INDUSTRIAL CO., LTD. 0.0
 HAAN Corporation 0.0
 DAE WON KANG UP CO., LTD. 0.0
 Sanko Seiki Co. Ltd 0.0
 Uchida Yoko Co., Ltd. 0.0
 CTA Technology (Proprietary) Limited 0.0
 Mitsubishi Shindoh Co., Ltd. 0.0
 Fujitsu Telecom Networks Limited 0.0
 Sociedad Anonima Espanola de Tarjetas de Identification y Credito 0.0
 Intelligent Data, S.L. 0.0

Sumitomo Electric Hardmetal Corp. 0.0
 Sumitomo (SEI) Steel Wire Corp. 0.0
 Sumitomo Electric Toyama Co., Ltd. 0.0
 Tomey Co., Ltd. 0.0
 Kabushiki Kaisha Toyota Jidoshokki 0.0
 TPR Industry Co. 0.0
 Tradik Co. LTD 0.0
 National Institute of Advanced Industrial Science and Technology 0.0
 Mitsui Engineering & Shipbuilding Co., Ltd. 0.0
 Chinese Academy of Sciences 0.0
 The Institute of Optics and Electronics 0.0
 FURUI PRECISE COMPONENT (KUNSHAN) CO., LTD. 0.0
 Foxconn Technology Co., Ltd. 0.0
 Kokichi Terajima 0.0
 Xinhongzhou Precision Technology Co., Ltd 0.0
 Micro Win Tech Inc. 0.0
 LARGAN PRECISION CO., LTD. 0.0
 Industry-University Cooperation Foundation Hanyang University 0.0
 Shicoh Motor (Shanghai) Co., Ltd. 0.0
 SHINCRON CO., LTD. 0.0
 MAHLE Engine Systems UK Limited 0.0
 Mahle International GmbH 0.0
 Hyundai Motor Europe Technical Center GmbH 0.0
 GDS Software (ShenZhen) Co., Ltd 0.0
 A School Corporation Kansai University 0.0
 SEKISUI CHEMICAL CO., LTD. 0.0
 Illinois Tool Works Inc. 0.0
 Neumayer Tekfor Holding GmbH 0.0
 Hofer PDC GmbH 0.0
 TDK Corporation 0.0
 Preoptix (Jiangsu) Co. Ltd. 0.0
 Jatco Ltd 0.0
 BYD Company Limited 0.0
 SHENZHEN BYD AUTO R&D COMPANY LIMITED 0.0
 Sony Corporation 0.0
 Tazmo Co., Ltd. 0.0
 Inalfa Roof Systems Korea Ltd. 0.0
 Korea Advanced Institute of Science & Technology 0.0
 IUCF-HYU (INDUSTRY-UNIVERSITY COOPERATION FOUNDATION HANYANG UNIVERSITY) 0.0
 S.T. Corporation 0.0
 Yong San Co., Ltd. 0.0
 Webasto Donghee Holdings Co., Ltd. 0.0
 Samshin Precision Co., Ltd. 0.0
 Kavlico Corporation 0.0
 Faurecia Automotive Seating Canada Limited 0.0
 Hanix Co., Ltd. 0.0
 Howmedica Osteonics Corp. 0.0
 The University of Liverpool 0.0

SUMITOMO RIKO COMPANY LIMITED 0.0
 NEC Energy Devices, Ltd. 0.0
 Apeldyn Corporation 0.0
 Koito Seisakusho Co. Ltd. 0.0
 Loadmaster Universal Rigs, Inc. 0.0
 Canyon Oak Energy LLC 0.0
 TK Holdings Inc. 0.0
 SCIVAX CORPORATION 0.0
 Maruzen Petrochemical Co., Ltd. 0.0
 NHK International Corporation 0.0
 NHK Spring Co., Ltd. 0.0
 Aisin Keikinzoku Kabushiki Kaisha 0.0
 Miner Enterprises, Inc. 0.0
 POWERBRACE CORPORATION 0.0
 Sumisho Airbag Systems Co., Ltd. 0.0
 Asahi Kasei Engineering Corporation 0.0
 Max-Planck-Gesellschaft zur Foerderung der Wissenschaften E.V. 0.0
 Ludwig-Maximilians-Universitat Munchen 0.0
 Linde Aktiengesellschaft 0.0
 Siemens Plc 0.0
 Baxter International Inc. 0.0
 Baxter Healthcare S.A. 0.0
 Panasonic Ecology Systems Guangdong Co., Ltd. 0.0
 Panasonic Corporation 0.0
 GROB-WERKE GmbH & Co. KG 0.0
 Nagel Maschinen-und Werkzeugfabrik GmbH 0.0
 TOSHIBA MATERIALS CO., LTD. 0.0
 Toshiba Consumer Electronics Holdings Corporation 0.0
 WELLGO PEDAL'S CORP. 0.0
 Giant Manufacturing Co., Ltd. 0.0
 Polymatech Co., Ltd. 0.0
 Nanotech Industries, Inc. 0.0
 Daye Nonferrous Metals Co., Ltd. 0.0
 Daye Nonferrous Design and Research Institute Co., Ltd. 0.0
 Shimizu Industry Co., Ltd. 0.0
 KYOSHIN KOGYO CO., LTD. 0.0
 NILES WERKZEUGMASCHINEN GMBH 0.0
 KAPP GMBH 0.0
 KINPO ELECTRONICS, INC. 0.0
 IMEC 0.0
 Katholieke Universiteit Leuven, K.U. Leuven R&D 0.0
 Uniphase Corporation 0.0
 TOYODA IRON WORKS CO., LTD. 0.0
 NEC Access Technica, Ltd. 0.0
 NEC Engineering, Ltd. 0.0
 Ace Specialty, Inc. 0.0
 Grace Premier Fitness and Wellness Products, Inc. 0.0
 Continental Automotive GmbH 0.0

Continental Automotive France 0.0
Tsinghua University 0.0
Hong Fu Jin Precision Industry (ShenZhen) Co., Ltd. 0.0
Fu Tai Hua Industry (Shenzhen) Co., Ltd. 0.0
NCR Corporation 0.0
Deutsche Gesetzliche Unfallversicherung e.V. 0.0
Hochschule Bonn-Rhein-Sieg 0.0
Value Extraction LLC 0.0
SZUBA CONSULTING, INC. 0.0
CHENGDU BOE OPTOELECTRONICS TECHNOLOGY CO., LTD. 0.0
Crucible Intellectual Property, LLC 0.0
Apple Inc. 0.0
Holland, L.P. 0.0
Trinity Industries, Inc. 0.0
THE OHIO STATE UNIVERSITY 0.0
Faurecia Automotive Seating, LLC 0.0
Dr. Ing. h.c. F. Porsche Aktiengesellschaft 0.0
Apollo Vredestein B.V. 0.0
Advics Co., Ltd. 0.0
Honda Access Corp. 0.0
MTU Aero Engines GmbH 0.0
Stanley Electric Co., Ltd. 0.0
Daifuku (China) Co., Ltd. 0.0
Daifuku Co., Ltd. 0.0
Toyota Motor Corporation 0.0
Optoelectronics Co., Ltd. 0.0
Optichron, Inc. 0.0
Hayashi Telempu Co., Ltd. 0.0
Toyota Boshoku Kabushiki Kaisha 0.0
Universal Scientific Industrial Co., Ltd. 0.0
Universal Global Scientific Industrial Co., Ltd. 0.0
Toyooki Kogyo Co., Ltd. 0.0
Roche Diagnostics International AG 0.0
Roche Diagnostics Operations, Inc. 0.0
ASIA OPTICAL INTERNATIONAL LTD. 0.0
Sintai Optical (Shenzhen) Co., Ltd. 0.0
Ford Global Technologies, LLC 0.0
KSR Technologies Co. 0.0
Carl Zeiss SMT AG 0.0
ASML Netherlands B.V. 0.0
Swift Water Logistics, Inc. 0.0
Magline, Inc. 0.0
GWANGJU INSTITUTE OF SCIENCE AND TECHNOLOGY 0.0
INHA Industry Partnership Institute 0.0
Tohoku University 0.0
Seiko Epson Corporation 0.0
Japan Science and Technology Agency 0.0
The Regents of the University of California 0.0

YACHIYO INDUSTRIAL CO., LTD. 0.0
 McLaren Racing Limited 0.0
 Cambridge Enterprise Limited 0.0
 The President and Fellows of Harvard College 0.0
 Fibrotec AG 0.0
 Eidgenossische Materialprüfungs-Und Forschungsanstalt EMPA 0.0
 DENSO International America, Inc. 0.0
 Toyota Gosei North America Corporation 0.0
 NSK LTD. 0.0
 EADS Deutschland GmbH 0.0
 Oak Manufacturing Company 0.0
 Parsal Vending Supply, LLC 0.0
 Chung Shan Institute of Science and Technology Armaments Bureau, M.N.D. 0.0
 Customs Administration, Ministry of Finance, R.O.C. 0.0
 Saga Tekkohsho Co., Ltd. 0.0
 NETZSCH Pumpen & Systeme GmbH 0.0
 HEISHIN LTD. 0.0
 Canon Nanotechnologies, Inc. 0.0
 Molecular Imprints, Inc. 0.0
 DePuy Synthes Products, LLC 0.0
 Agency for Science, Technology and Research 0.0
 Delta Electronics (Shanghai) Co., Ltd. 0.0
 Polaris Industries Inc. 0.0
 Clark Equipment Company 0.0
 Centre Luxembourgeois de Recherches pour le Verre et la Ceramique S.A.
 (C.R.V.C.) 0.0
 Guardian Industries Corp. 0.0
 DaikyoNishikawa Corporation 0.0
 The General Hospital Corporation 0.0
 Cambridge Polymer Group, Inc. 0.0
 NHN Corporation 0.0
 Nakanishi Metal Works Co., Ltd. 0.0
 Nissin Kogyo Co., Ltd. 0.0
 The University of British Columbia 0.0
 Westport Power Inc. 0.0
 NIPPON SHARYO, LTD. 0.0
 Pneumatic Servo Controls Ltd. 0.0
 Mitsubishi Jidosha Kogyo Kabushiki Kaisha 0.0
 Hiruta-Kogyo Co., Ltd. 0.0
 Kinki University 0.0
 Osaka Prefecture University Public Corporation 0.0
 ILB Co., Ltd. 0.0
 Kyosan Denki Co., Ltd. 0.0
 Rex Industries Co., Ltd. 0.0
 Bandai Co., Ltd. 0.0
 Doefer Companies 0.0
 Cooper Industries, Inc. 0.0
 Bridgestone Corporation 0.0

Konami Co., Ltd. 0.0
Gentest Corporation 0.0
Kobe Steel, Limited 0.0
Kobelco Construction Machinery Co., Ltd. 0.0
AAC Acoustic Technologies (Shenzhen) Co., Ltd. 0.0
American Audio Components Inc. 0.0

```
[ ]: # closeness centrality
      closeness = nx.closeness centrality(us_graph)
      for w in sorted(closeness, key=closeness.get, reverse=True):
          print(w, closeness[w])
```

Hyundai Motor Company 0.0578894472361809
Toyota Jidosha Kabushiki Kaisha 0.04274846454494696
Honda Motor Co., Ltd. 0.041593100638326774
Tokai Rubber Industries, Ltd. 0.04103852596314908
Denso Corporation 0.037535237161416844
Kia Motors Corporation 0.03710862002319289
Nippon Soken, Inc. 0.03708300538838773
Kia Motors Corp. 0.03289173138419369
Hyundai Motor Japan R&D Center 0.03146165610662006
Seohan Industry Co., Ltd. 0.03146165610662006
Pyeong Hwa Valeo CO., LTD. 0.03146165610662006
Myocogen Corporation 0.03146165610662006
Keyang Electric Machinery Co., Ltd. 0.03146165610662006
Hyundai Motor Europe Technical Center GmbH 0.03146165610662006
Korea Advanced Institute of Science & Technology 0.03146165610662006
Yong San Co., Ltd. 0.03146165610662006
Samshin Precision Co., Ltd. 0.03146165610662006
Kavlico Corporation 0.03146165610662006
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DONG HEE INDUSTRIAL CO., LTD. 0.03079225916818133
HAAN Corporation 0.03079225916818133
DAE WON KANG UP CO., LTD. 0.03079225916818133
AISIN SEIKI KABUSHIKI KAISHA 0.030474152942932483
Industry-University Cooperation Foundation Hanyang University
0.03015075376884422
Inalfa Roof Systems Korea Ltd. 0.03015075376884422
IUCF-HYU (INDUSTRY-UNIVERSITY COOPERATION FOUNDATION HANYANG UNIVERSITY)
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S.T. Corporation 0.03015075376884422
Webasto Donghee Holdings Co., Ltd. 0.03015075376884422
Faurecia Automotive Seating Canada Limited 0.03015075376884422
Hanix Co., Ltd. 0.03015075376884422
Aisin AW Co., Ltd. 0.029882421817827003
JTEKT Corporation 0.029882421817827003
Fuji Kiko Co., Ltd. 0.029595090838809436
MEC International Co., Ltd. 0.029036692898454536

Fuji Jukogyo Kabushiki Kaisha 0.029036692898454536
 Toyo Tire & Rubber Co., Ltd. 0.029036692898454536
 Toyoda Gosei Co., Ltd. 0.029036692898454536
 Yamaha Hatsudoki Kabushiki Kaisha 0.029036692898454536
 Toyota Motor East Japan, Inc. 0.029036692898454536
 Taiho Kogyo, Ltd. 0.029036692898454536
 Mitsui High-Tec, Inc. 0.029036692898454536
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 Novelis Inc. 0.02876532193678674
 Takata Corporation 0.028498976363297974
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 Keihin Corporation 0.028498976363297974
 Illinois Tool Works Inc. 0.028498976363297974
 Honda Access Corp. 0.028498976363297974
 NSK LTD. 0.028498976363297974
 Saga Tekkohsho Co., Ltd. 0.028498976363297974
 Nissin Kogyo Co., Ltd. 0.028498976363297974
 Bridgestone Corporation 0.028498976363297974
 Gentest Corporation 0.028498976363297974
 Hitachi Metals, Ltd. 0.026533529717553284
 Advics Co., Ltd. 0.026533529717553284
 DENSO International America, Inc. 0.026533529717553284
 Kyosan Denki Co., Ltd. 0.026533529717553284
 Faurecia Automotive Seating, LLC 0.023342519046847136
 Aisin Keikinzoku Kabushiki Kaisha 0.022799181090638377
 Konami Co., Ltd. 0.022799181090638377
 Toyooki Kogyo Co., Ltd. 0.022466346330191105
 GM Global Technology Operations, Inc. 0.02035175879396985
 Chrysler Group LLC 0.014536970567121322
 Daimler-Benz AG 0.013567839195979899
 Bayerische Motoren Werke Aktiengesellschaft 0.013567839195979899
 Airbus Helicopters 0.01292175161521895
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 Nissan Motor Co., Ltd. 0.01256281407035176
 Peugeot Citroen Automobiles SA 0.011306532663316583
 Wisconsin Alumni Research Foundation 0.011306532663316583
 Université Laval 0.011306532663316583
 The United States of America as represented by the Administrator of the National
 Aeronautics and Space Administration 0.011306532663316583
 Kao Corporation 0.011306532663316583
 Airbus Helicopters Deutschland GmbH 0.011306532663316583
 Kabushiki Kaisha Toshiba 0.011306532663316583
 NIPPON STEEL & SUMITOMO METAL CORPORATION 0.010050251256281407
 Fischer + Entwicklungen GmbH & Co KG 0.010050251256281405
 Schroth Safety Products GmbH 0.010050251256281405
 TK Holdings Inc. 0.009250799451804478
 Thales 0.008973438621679828

Centre National d'Etudes Spatiales 0.008973438621679828
 UNIVERSITE D 'AIX-MARSEILLE 0.008973438621679828
 TOSHIBA TEC KABUSHIKI KAISHA 0.008222932846048423
 The Japan Steel Works, Ltd. 0.008222932846048423
 Tesla Motors, Inc. 0.008222932846048423
 CPE Lyon 0.007537688442211055
 UNIVERSITE CLAUDE BERNARD LYON I 0.007537688442211055
 CNRS-Centre National de la Recherche Scientifique 0.007537688442211055
 COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
 0.007537688442211055
 Samsung Electronics Co., Ltd. 0.007537688442211055
 EADS (European Aeronautic Defence And Space Company EADS France)
 0.007537688442211055
 Ecole Naitonale Supérieure d'Arts et Métiers-E.N.S.A.M 0.007537688442211055
 Sumitomo Electric Industries, Ltd. 0.007537688442211055
 Kokichi Terajima 0.007537688442211055
 Xinhongzhou Precision Technology Co., Ltd 0.007537688442211055
 Micro Win Tech Inc. 0.007537688442211055
 LARGAN PRECISION CO., LTD. 0.007537688442211055
 Toyota Motor Engineering & Manufacturing North America, Inc.
 0.007537688442211055
 Nishikawa Rubber Co., Ltd. 0.007537688442211055
 IXFIBER 0.006979341150195422
 UNIVERSITE PIERRE ET MARIE CURIE (PARIS 6) 0.006979341150195422
 Premier Image Technology(China) Ltd. 0.006979341150195422
 GDS Software (ShenZhen) Co., Ltd 0.006979341150195422
 Jatco Ltd 0.006979341150195422
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 NEC Energy Devices, Ltd. 0.006979341150195422
 Apeldyn Corporation 0.006979341150195422
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 Tsinghua University 0.006979341150195422
 Hong Fu Jin Precision Industry (ShenZhen) Co., Ltd. 0.006979341150195422
 Fu Tai Hua Industry (Shenzhen) Co., Ltd. 0.006979341150195422
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 Toshiba Consumer Electronics Holdings Corporation 0.006957866254348666
 EADS Deutschland GmbH 0.006957866254348666
 Mazda Motor Corporation 0.006030150753768844
 Sumitomo Pipe & Tube Co., Ltd. 0.005743000717875089
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 Uniphase Corporation 0.005743000717875089
 TOYODA IRON WORKS CO., LTD. 0.005743000717875089
 Canon Kabushiki Kaisha 0.005653266331658292
 The Arizona Board of Regents on behalf of the University of Arizona
 0.005653266331658292
 Massachusetts Institute of Technology 0.005653266331658292
 NOK Corporation 0.005653266331658292
 National Institute for Materials Science 0.005653266331658292

Board of Regents, University of Texas System 0.005653266331658292
 NCR Corporation 0.005653266331658292
 YACHIYO INDUSTRIAL CO., LTD. 0.005653266331658292
 Toyota Motor Corporation 0.0053207212533254505
 Toyoda Gosei North America Corporation 0.0053207212533254505
 Motex Products Co., Ltd. 0.005025125628140704
 Industry-Univ. Cooperation Foundation of Korea Aerospace Univ.
 0.005025125628140704
 Kookmin Univ. Industry Academy Cooperation Foundation 0.005025125628140704
 BOE TECHNOLOGY GROUP CO., LTD. 0.005025125628140704
 The Furukawa Electric Co., Ltd. 0.005025125628140704
 National Institute of Information and Communications Technology
 0.005025125628140704
 Fujigiken Co., Ltd. 0.005025125628140704
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 Osaka Prefecture University Public Corporation 0.005025125628140704
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 Chungbuk National University Industry Academic Cooperation Foundation
 0.004522613065326633
 Kumoh National Institute of Technology Industry-Academic Cooperation Foundation
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 Sumitomo (SEI) Steel Wire Corp. 0.004522613065326633
 Sumitomo Electric Toyama Co., Ltd. 0.004522613065326633
 DaikyoNishikawa Corporation 0.004522613065326633
 Alps Electric Co., Ltd. 0.0037688442211055275
 The Trustees of Boston College 0.0037688442211055275
 Nikon Engineering Co., Ltd. 0.0037688442211055275
 FUJIKURA LTD. 0.0037688442211055275
 The University of Kansas 0.0037688442211055275
 The President and Fellows of Harvard College 0.0037688442211055275
 BEIJING BOE DISPLAY TECHNOLOGY CO., LTD. 0.0033500837520938024
 Fujitsu Optical Components Limited 0.0033500837520938024
 FURUKAWA AUTOMOTIVE SYSTEMS INC. 0.0033500837520938024
 OPTOQUEST CO., LTD. 0.0033500837520938024

Fujitsu Ten Limited 0.0033500837520938024
 Cal-Comp Precision (Singapore) Limited 0.0033500837520938024
 Citizen Machinery Co., Ltd 0.0033500837520938024
 Citizen Systems Japan Co., Ltd. 0.0033500837520938024
 Headway Technologies, Inc. 0.0033500837520938024
 CTA Technology (Proprietary) Limited 0.0033500837520938024
 Mitsubishi Shindoh Co., Ltd. 0.0033500837520938024
 Fujitsu Telecom Networks Limited 0.0033500837520938024
 TDK Corporation 0.0033500837520938024
 Preoptix (Jiangsu) Co. Ltd. 0.0033500837520938024
 KINPO ELECTRONICS, INC. 0.0033500837520938024
 CHENGDU BOE OPTOELECTRONICS TECHNOLOGY CO., LTD. 0.0033500837520938024
 THE OHIO STATE UNIVERSITY 0.0033500837520938024
 MTU Aero Engines GmbH 0.0033500837520938024
 Stanley Electric Co., Ltd. 0.0033500837520938024
 Delta Electronics (Shanghai) Co., Ltd. 0.0033500837520938024
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 Reduction Engineering, Inc. 0.002512562814070352
 Orion Engineered Carbons GbmH 0.002512562814070352
 New Jersey Institute of Technology 0.002512562814070352
 RFCyber Corp. 0.002512562814070352
 Rich House Global Technology Ltd. 0.002512562814070352
 MARUISHI SANYO CO., LTD 0.002512562814070352
 Kuraray Co., Ltd. 0.002512562814070352
 Federal State Budgetary Institution "Federal Agency for Legal Protection of
 Military, Special and Dual Use Intellectual Activity Results" (FSBI "FALPIAR")
 0.002512562814070352
 Zakritoe Aktzionernoe Obschestvo 'TSENTR' 'VOSPI' (VOSPI Center CJSC (Closed
 Stock Company)) 0.002512562814070352
 Volex PLC 0.002512562814070352
 Applied Micro Circuits Corporation 0.002512562814070352
 Vestas Wind Systems A/S 0.002512562814070352
 ZF Friedrichshafen AG 0.002512562814070352
 Polytech Kagawa, Co., Ltd. 0.002512562814070352
 Institute of National Colleges of Technology, Japan 0.002512562814070352
 Carl Zeiss SMT GmbH 0.002512562814070352
 Carl Zeiss Laser Optics GmbH 0.002512562814070352
 Tong Oil Tools Co., Ltd. 0.002512562814070352
 Tong Petrotech Inc 0.002512562814070352
 Tatsumi Seiki Co., Ltd. 0.002512562814070352
 Japan Agency for Marine-Earth Science and Technology 0.002512562814070352
 Gunze Limited 0.002512562814070352
 SHIMANO INC. 0.002512562814070352
 King Slide Works Co., Ltd. 0.002512562814070352
 King Slide Technology Co., Ltd. 0.002512562814070352
 Tokyo Institute of Technology 0.002512562814070352
 Tokyo Medical and Dental University 0.002512562814070352
 SAGE ELECTROCHROMICS, INC. 0.002512562814070352

Alliance for Sustainable Energy, LLC 0.002512562814070352
 Shenzhen Futaihong Precision Industry Co., Ltd. 0.002512562814070352
 FIH (Hong Kong) Limited 0.002512562814070352
 Industry-University Cooperation Foundation Korea Aerospace University
 0.002512562814070352
 KOOKMIN UNIVERSITY INDUSTRY ACADEMY COOPERATION FOUNDATION 0.002512562814070352
 Shanghai Maple Guorun Automobile Co 0.002512562814070352
 Zhejiang Geely Holding Group Co., Ltd 0.002512562814070352
 THE UNIVERSITY OF CONNECTICUT 0.002512562814070352
 Otis Elevator Company 0.002512562814070352
 Carib Design Service Inc. 0.002512562814070352
 Mamiya-Op Co., Ltd. 0.002512562814070352
 Danfoss Low Power Drives 0.002512562814070352
 Pentair Water Pool and Spa, Inc. 0.002512562814070352
 Curators of the University of Missouri 0.002512562814070352
 Regency Technologies LLC 0.002512562814070352
 Shin-Etsu Quartz Products Co., Ltd. 0.002512562814070352
 Opto-Electronics Laboratory, Inc. 0.002512562814070352
 Golden Sun News Techniques Co., Ltd. 0.002512562814070352
 Cpumate Inc. 0.002512562814070352
 E. I. du Pont de Nemours and Company 0.002512562814070352
 NANO TECHNICS COMPANY LTD 0.002512562814070352
 Wincor Nixdorf International GmbH 0.002512562814070352
 Crane Payment Solutions GmbH 0.002512562814070352
 Fast & Fluid Management B.V. 0.002512562814070352
 Starstatus Trading Internacional LDA 0.002512562814070352
 Toppan Printing Co., Ltd. 0.002512562814070352
 Hisamitsu Pharmaceutical Co., Ltd. 0.002512562814070352
 LG CNS CO., LTD. 0.002512562814070352
 Robotis Co., Ltd. 0.002512562814070352
 Saint-Gobain Abrasifs 0.002512562814070352
 Saint-Gobain Abrasifs Technologie ET Services 0.002512562814070352
 MAR Systems, Inc. 0.002512562814070352
 Siemens Aktiengesellschaft 0.002512562814070352
 Volkswagen AG 0.002512562814070352
 Sicon GmbH 0.002512562814070352
 Reynolds Systems, Inc. 0.002512562814070352
 Alliant Techsystems, Inc. 0.002512562814070352
 ZTE (USA) Inc. 0.002512562814070352
 ZTE Corporation 0.002512562814070352
 Zhong Da National Engineering and Research Center of Continuous Casting
 Technology Co. Ltd. 0.002512562814070352
 CENTRAL IRON AND STEEL RESEARCH INSTITUTE 0.002512562814070352
 Faurecia Interieur Industrie 0.002512562814070352
 Faurecia Innenraum Systeme GmbH 0.002512562814070352
 Michelin Recherche et Technique S.A. 0.002512562814070352
 Compagnie Generale des Etablissements Michelin 0.002512562814070352
 Optical Logic Inc. 0.002512562814070352

KANTATSU CO., LTD. 0.002512562814070352
 Rolls-Royce Corporation 0.002512562814070352
 Rolls-Royce North American Technologies Inc. 0.002512562814070352
 Sanko Seiki Co. Ltd 0.002512562814070352
 Uchida Yoko Co., Ltd. 0.002512562814070352
 Sociedad Anonima Espanola de Tarjetas de Identification y Credito
 0.002512562814070352
 Intelligent Data, S.L. 0.002512562814070352
 Tomey Co., Ltd. 0.002512562814070352
 Kabushiki Kaisha Toyota Jidoshokki 0.002512562814070352
 TPR Industry Co. 0.002512562814070352
 Tradik Co. LTD 0.002512562814070352
 National Institute of Advanced Industrial Science and Technology
 0.002512562814070352
 Mitsui Engineering & Shipbuilding Co., Ltd. 0.002512562814070352
 Chinese Academy of Sciences 0.002512562814070352
 The Institute of Optics and Electronics 0.002512562814070352
 FURUI PRECISE COMPONENT (KUNSHAN) CO., LTD. 0.002512562814070352
 Foxconn Technology Co., Ltd. 0.002512562814070352
 Shicoh Motor (Shanghai) Co., Ltd. 0.002512562814070352
 SHINCRON CO., LTD. 0.002512562814070352
 MAHLE Engine Systems UK Limited 0.002512562814070352
 Mahle International GmbH 0.002512562814070352
 A School Corporation Kansai University 0.002512562814070352
 SEKISUI CHEMICAL CO., LTD. 0.002512562814070352
 Neumayer Tekfor Holding GmbH 0.002512562814070352
 Hofer PDC GmbH 0.002512562814070352
 BYD Company Limited 0.002512562814070352
 SHENZHEN BYD AUTO R&D COMPANY LIMITED 0.002512562814070352
 Sony Corporation 0.002512562814070352
 Tazmo Co., Ltd. 0.002512562814070352
 Howmedica Osteonics Corp. 0.002512562814070352
 The University of Liverpool 0.002512562814070352
 Loadmaster Universal Rigs, Inc. 0.002512562814070352
 Canyon Oak Energy LLC 0.002512562814070352
 SCIVAX CORPORATION 0.002512562814070352
 Maruzen Petrochemical Co., Ltd. 0.002512562814070352
 NHK International Corporation 0.002512562814070352
 NHK Spring Co., Ltd. 0.002512562814070352
 Miner Enterprises, Inc. 0.002512562814070352
 POWERBRACE CORPORATION 0.002512562814070352
 Sumisho Airbag Systems Co., Ltd. 0.002512562814070352
 Asahi Kasei Engineering Corporation 0.002512562814070352
 Max-Planck-Gesellschaft zur Foerderung der Wissenschaften E.V.
 0.002512562814070352
 Ludwig-Maximilians-Universitat Munchen 0.002512562814070352
 Linde Aktiengesellschaft 0.002512562814070352
 Siemens Plc 0.002512562814070352

Baxter International Inc. 0.002512562814070352
 Baxter Healthcare S.A. 0.002512562814070352
 Panasonic Ecology Systems Guangdong Co., Ltd. 0.002512562814070352
 Panasonic Corporation 0.002512562814070352
 GROB-WERKE GmbH & Co. KG 0.002512562814070352
 Nagel Maschinen-und Werkzeugfabrik GmbH 0.002512562814070352
 WELLGO PEDAL'S CORP. 0.002512562814070352
 Giant Manufacturing Co., Ltd. 0.002512562814070352
 Polymatech Co., Ltd. 0.002512562814070352
 Nanotech Industries, Inc. 0.002512562814070352
 Daye Nonferrous Metals Co., Ltd. 0.002512562814070352
 Daye Nonferrous Design and Research Institute Co., Ltd. 0.002512562814070352
 Shimizu Industry Co., Ltd. 0.002512562814070352
 KYOSHIN KOGYO CO., LTD. 0.002512562814070352
 NILES WERKZEUGMASCHINEN GMBH 0.002512562814070352
 KAPP GMBH 0.002512562814070352
 IMEC 0.002512562814070352
 Katholieke Universiteit Leuven, K.U. Leuven R&D 0.002512562814070352
 NEC Access Technica, Ltd. 0.002512562814070352
 NEC Engineering, Ltd. 0.002512562814070352
 Ace Specialty, Inc. 0.002512562814070352
 Grace Premier Fitness and Wellness Products, Inc. 0.002512562814070352
 Continental Automotive GmbH 0.002512562814070352
 Continental Automotive France 0.002512562814070352
 Deutsche Gesetzliche Unfallversicherung e.V. 0.002512562814070352
 Hochschule Bonn-Rhein-Sieg 0.002512562814070352
 Value Extraction LLC 0.002512562814070352
 SZUBA CONSULTING, INC. 0.002512562814070352
 Crucible Intellectual Property, LLC 0.002512562814070352
 Apple Inc. 0.002512562814070352
 Holland, L.P. 0.002512562814070352
 Trinity Industries, Inc. 0.002512562814070352
 Dr. Ing. h.c. F. Porsche Aktiengesellschaft 0.002512562814070352
 Apollo Vredestein B.V. 0.002512562814070352
 Daifuku (China) Co., Ltd. 0.002512562814070352
 Daifuku Co., Ltd. 0.002512562814070352
 Optoelectronics Co., Ltd. 0.002512562814070352
 Optichron, Inc. 0.002512562814070352
 Hayashi Telempu Co., Ltd. 0.002512562814070352
 Toyota Boshoku Kabushiki Kaisha 0.002512562814070352
 Universal Scientific Industrial Co., Ltd. 0.002512562814070352
 Universal Global Scientific Industrial Co., Ltd. 0.002512562814070352
 Roche Diagnostics International AG 0.002512562814070352
 Roche Diagnostics Operations, Inc. 0.002512562814070352
 ASIA OPTICAL INTERNATIONAL LTD. 0.002512562814070352
 Sintai Optical (Shenzhen) Co., Ltd. 0.002512562814070352
 Ford Global Technologies, LLC 0.002512562814070352
 KSR Technologies Co. 0.002512562814070352

Carl Zeiss SMT AG 0.002512562814070352
ASML Netherlands B.V. 0.002512562814070352
Swift Water Logistics, Inc. 0.002512562814070352
Magline, Inc. 0.002512562814070352
GWANGJU INSTITUTE OF SCIENCE AND TECHNOLOGY 0.002512562814070352
INHA Industry Partnership Institute 0.002512562814070352
Tohoku University 0.002512562814070352
Seiko Epson Corporation 0.002512562814070352
Japan Science and Technology Agency 0.002512562814070352
The Regents of the University of California 0.002512562814070352
McLaren Racing Limited 0.002512562814070352
Cambridge Enterprise Limited 0.002512562814070352
Fibrotec AG 0.002512562814070352
Eidgenossische Materialprüfungs-Und Forschungsanstalt EMPA 0.002512562814070352
Oak Manufacturing Company 0.002512562814070352
Parsal Vending Supply, LLC 0.002512562814070352
Chung Shan Institute of Science and Technology Armaments Bureau, M.N.D.
0.002512562814070352
Customs Administration, Ministry of Finance, R.O.C. 0.002512562814070352
NETZSCH Pumpen & Systeme GmbH 0.002512562814070352
HEISHIN LTD. 0.002512562814070352
Canon Nanotechnologies, Inc. 0.002512562814070352
Molecular Imprints, Inc. 0.002512562814070352
DePuy Synthes Products, LLC 0.002512562814070352
Agency for Science, Technology and Research 0.002512562814070352
Polaris Industries Inc. 0.002512562814070352
Clark Equipment Company 0.002512562814070352
Centre Luxembourgeois de Recherches pour le Verre et la Ceramique S.A.
(C.R.V.C.) 0.002512562814070352
Guardian Industries Corp. 0.002512562814070352
The General Hospital Corporation 0.002512562814070352
Cambridge Polymer Group, Inc. 0.002512562814070352
NHN Corporation 0.002512562814070352
Nakanishi Metal Works Co., Ltd. 0.002512562814070352
The University of British Columbia 0.002512562814070352
Westport Power Inc. 0.002512562814070352
NIPPON SHARYO, LTD. 0.002512562814070352
Pneumatic Servo Controls Ltd. 0.002512562814070352
Mitsubishi Jidosha Kogyo Kabushiki Kaisha 0.002512562814070352
Hiruta-Kogyo Co., Ltd. 0.002512562814070352
Rex Industries Co., Ltd. 0.002512562814070352
Bandai Co., Ltd. 0.002512562814070352
Doefer Companies 0.002512562814070352
Cooper Industries, Inc. 0.002512562814070352
Kobe Steel, Limited 0.002512562814070352
Kobelco Construction Machinery Co., Ltd. 0.002512562814070352
AAC Acoustic Technologies (Shenzhen) Co., Ltd. 0.002512562814070352
American Audio Components Inc. 0.002512562814070352