Global Value Chain Analysis with Machine Learning Techniques

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I. Introduction

A value chain is a set of all processes that add value to the time a service or good is sold to consumers. For example, the value chain of the electric vehicle can include all raw materials and intermediate goods transactions and services from the time a single electric vehicle is sold to the processing of iron and lithium, which are raw materials, to the time when it is assembled, painted, and sold in factories. Analyzing the value chain is important for both companies and individuals. Firms can establish higher profit strategies at a lower cost by analyzing which value chain the revenue model is included in. It becomes easier for individuals to analyze the interests of companies through value chain analysis and generate profits through stock trading. Current value chain analysis involves a series of analyses, and this process is too complicated for ordinary individuals as various goods and services are rapidly emerging. In this report, I propose a way for ordinary individuals to analyze the global value chain with limited data resources by machine learning methodology.

The purpose of the study is to attempt to analyze a global value chain centered on goods only with trade data. After analyzing with the clustering technique, it aims to confirm that it matches the currently known value chain content and to discover a new value chain process.

II. Data Description

Data Source : After selecting 100 items in the balance of raw materials, intermediate goods, and finished goods, the Korea Customs Service has sourced data on import and export trade performance for three years monthly. In the same way, 300 additional goods were selected and sourced from US Comtrade data additionally.

Data Preprocessing : A feature of total trade data combining import and export amounts was created for each item, and time data were combined from monthly import and export statistics data to quarterly and goods-specific data. After that, the data were cut

so that 11 features were produced per item by calculating the rate of change of the total trade amount for the quarter. In addition, items with a rate of change of 5 or more or without several features due to data absence were removed as outliers.

III. Method

Three assumptions were used to build the method: First of all, goods within a value chain have a distance close to the rate of change in the total amount of trade. In addition, clustering is possible with only hyperplanes because all features have similar directions. Finally, the feature change of a good from raw materials to finished goods gives a certain feature change to the goods included in the subsequent process. In other words, the goods at the end of the chain order overlap with the influence of the feature change and have a closer distance.

Two clustering algorithms, KMeans clustering/spectral clustering algorithms, were applied using the quarterly rate of change in the total trade volume for each goods in Korea/the United States. Eleven rates of change in the total trade were used as features of each product, and the algorithm used Sklearn's clustering library. The resources were implemented both data preprocessing and clustering algorithms using Colab's CPU. The order of the chains was implemented using the Greedy Near Neighbor Traversal algorithm based on distance between features using the assumption of overlapping influences. Cluster visualization extracted the main components with pca and presented simply in the plot.

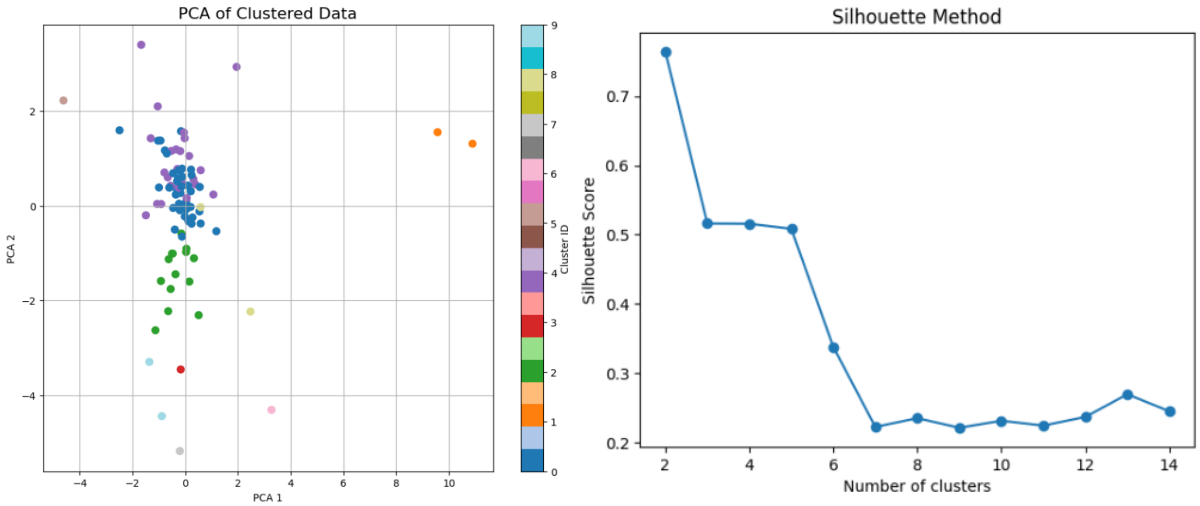
The Kmeans algorithm has to specify the number of clusters directly, and the clustering performance varies greatly depending on the number of clusters. Therefore, the silhouette score was used without specifying an arbitrary number of clusters. It is an algorithm-based score that measures on average which data is how close to the cluster containing it and how much dust it is from other clusters. The number of clusters with a high silhouette score was selected while having the maximum number of clusters in the range of 5-15 clusters. In addition, the number of 11 features is large, so a large difference in one feature has a large influence. Therefore, the dimension was reduced using the PCA algorithm and the overall aspect of the data was extracted at the same time.

IV. Result & Interpretation

Exact clusters contents would be in appendix because of the size issue.

1. Korean data with Kmeans+PCA+Silhouette score

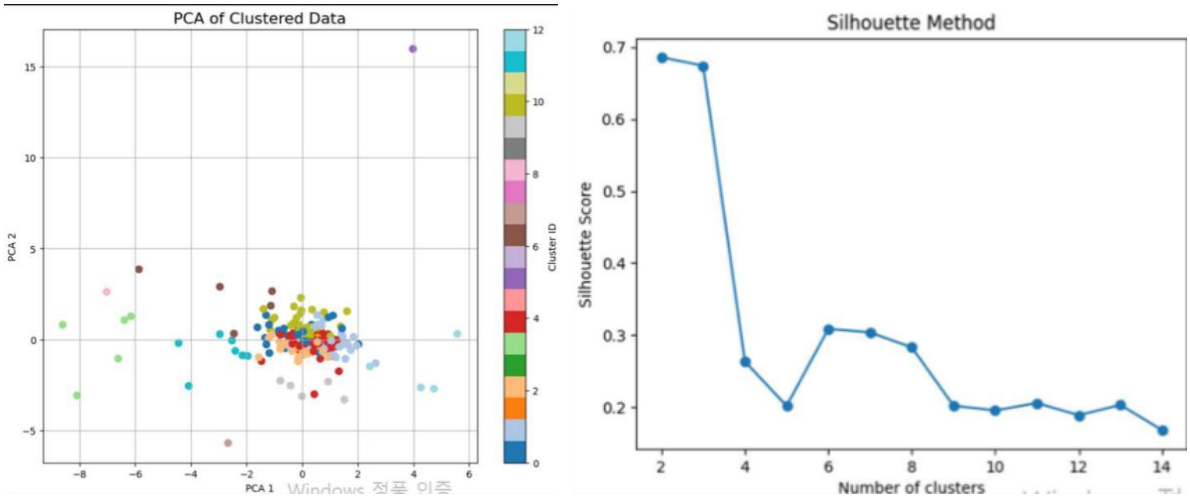
PCA component 4, 13 clusters



(Plotted clusters, Silhouette score where PCA=4)

2. US data with Kmeans+PCA+Silhouette score

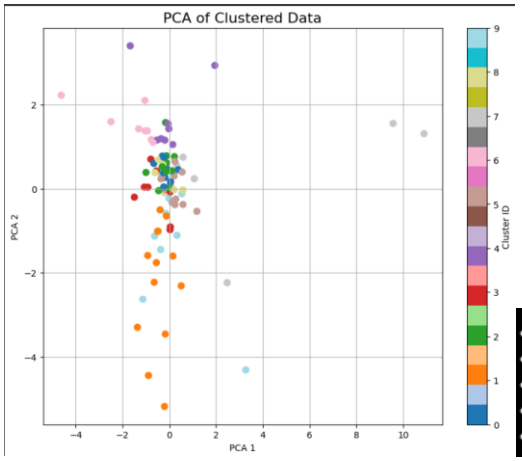
PCA component 4, 13 clusters



(Plotted clusters, Silhouette score where PCA=4)

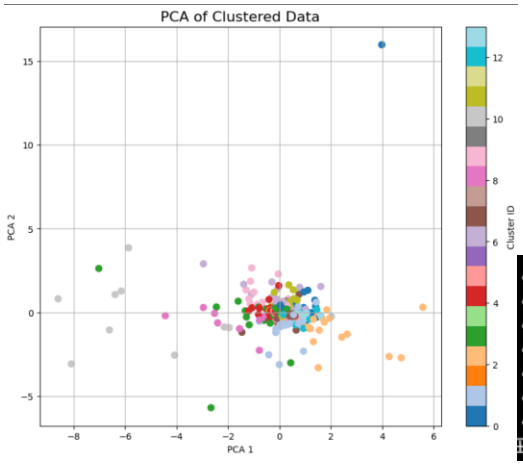
◇ 클러스터 0 체인 순서 (총 26개)
◇ 클러스터 1 체인 순서 (총 41개)
◇ 클러스터 2 체인 순서 (총 33개)
◇ 클러스터 3 체인 순서 (총 5개)
◇ 클러스터 4 체인 순서 (총 110개)
◇ 클러스터 5 체인 순서 (총 1개)
◇ 클러스터 6 체인 순서 (총 6개)
◇ 클러스터 7 체인 순서 (총 1개)
◇ 클러스터 8 체인 순서 (총 1개)
◇ 클러스터 9 체인 순서 (총 5개)
◇ 클러스터 10 체인 순서 (총 33개)
◇ 클러스터 11 체인 순서 (총 7개)
◇ 클러스터 12 체인 순서 (총 4개)
표준편차 : 30.353

3. Korean data with Spectral Clustering



◇ 클러스터 0 체인 순서 (총 8개) ◇ 클러스터 1 체인 순서 (총 6개)
◇ 클러스터 2 체인 순서 (총 14개) ◇ 클러스터 3 체인 순서 (총 8개)
◇ 클러스터 4 체인 순서 (총 7개) ◇ 클러스터 5 체인 순서 (총 15개)
◇ 클러스터 6 체인 순서 (총 12개) ◇ 클러스터 7 체인 순서 (총 14개)
◇ 클러스터 8 체인 순서 (총 8개) 표준편차 : 3.492

4. US data with Spectral Clustering



◇ 클러스터 0 체인 순서 (총 18개) ◇ 클러스터 1 체인 순서 (총 28개)
◇ 클러스터 2 체인 순서 (총 21개) ◇ 클러스터 3 체인 순서 (총 23개)
◇ 클러스터 4 체인 순서 (총 32개) ◇ 클러스터 5 체인 순서 (총 10개)
◇ 클러스터 6 체인 순서 (총 21개) ◇ 클러스터 7 체인 순서 (총 38개)
◇ 클러스터 8 체인 순서 (총 9개) ◇ 클러스터 9 체인 순서 (총 13개)
◇ 클러스터 10 체인 순서 (총 9개) ◇ 클러스터 11 체인 순서 (총 20개)
◇ 클러스터 12 체인 순서 (총 12개) ◇ 클러스터 13 체인 순서 (총 19개)
표준편차 : 8.768

In each cluster result, a trivial value chain process was captured. For example, goods produced through a process such as wood, paper, cotton, and cardboard were included in one cluster, and goods included in the production process such as cylinders, lights, and rotary converters were also included in one cluster. Looking at the clustering center, KMeans-based clustering tends to attract goods to few clusters. Therefore, goods within

several value chains with weak correlation are combined into one cluster, resulting in poor visibility. It is interpreted that clustering is difficult with a simple distance because the global economic synchronization, in which the values of goods move synchronously according to the economic cycle because the economies of each country are connected to each other, is large. On the other hand, in spectral clustering, since it clusters through the distance between clusters rather than the distance between clusters of data inside the cluster, it creates more uniform clusters and captures the trivial value chain process well. In the order of value in the order of finished goods -> intermediate goods -> raw materials, there were clusters that were well represented for US trade data, but for Korean data, the order of the value chain through the nearest order did not fit well. However, since the US data was not well applied to all clusters, it seems necessary to correct the assumption of overlapping effects.

V. Conclusion

In conclusion, the KMeans algorithm, which clusters by a simple distance of internal data, is vulnerable to outliers without considering the density between clusters, shows low performance in value chain analysis, while the spectral clustering algorithm is more suitable for value chain analysis by performing clustering using the distance between clusters and performing more balanced clustering. In addition, this clustering allowed us to capture the goods flow of the trivial global value chain. For example, in the results of spectral clustering with US data, the order of the production process of goods was well captured in the order of Medicine, Zinc, and Alcohols, and in the results of spectral clustering with Korean data, it was confirmed that the order of medical devices, semiconductor devices, X-ray devices, and motors was also well captured. In addition, non-trivial value chains are often successful in capturing. For example, industry-related goods and corn were included in the same cluster in each clustering result, reflecting the high use of corn as biofuel.

In terms of data, US trade data tend to capture more trivial value chains than Korean trade data. This seems to be the result of the low share of Korea's export/import market, which does not follow the international trend of goods value well, and the lower share of the service industry compared to other countries with a high share of the export/import market, which does not fully reflect the current global value chain.

The limitations of this study are as follows. First of all, the dual causal relationships between various goods were combined, not clear clustering, but clustering with several value chains appeared. In addition, in addition to geographic and cultural factors,

numerous variables in the global value chain change the added value, and the global value chain was analyzed only with macroscopic trade data. This cannot reflect elements of the value chain such as services or marketing. It also excludes the flow of the domestic economy. The reason why only trade data was used despite these limitations is that there is no data that can be used from the perspective of ordinary individuals. If there were transaction details data of all companies in all industries, it would have been possible to cluster all services, goods, and additional elements to more accurately analyze the value chain. In addition, the analysis of global value chains in which goods rotate worldwide was limited to a single country, such as Korea and the United States, as for trade data. Finally, the order in which value is added could be implemented within a cluster through the assumption of overlapping impacts, but it did not perform well with reality. If there is a lack of assumptions about the order, there is a problem that it is difficult to determine how the goods in one cluster added value in what process.

VI. Reference

◈ 한국 관세청 수출입통계 (Korea Customs Service)

Korea Customs Service. (2025). Export-Import Trade Statistics. Retrieved from https://unipass.customs.go.kr/ets/index.do

◈ UN Comtrade

United Nations. (2025). UN Comtrade Database. Department of Economic and Social Affairs, Statistics Division. Retrieved from https://comtrade.un.org/

VII. Appendix

Clustering results for 4 different methods

The chain order is the data with closer neighbors as it comes forward. In other words, according to the assumption of overlapping effects, the data that comes out first is a finished product, and the later it comes out, the raw material.

-Korea, KMeans

◇ 클러스터 0

따로 분류되지 않은 조제 식료품,전기식 조명용이나 신호용 기구(제8539호의 물품은 제외한다)・윈드스크린와이퍼(windscreen wiper)・제상기(defroster)・제무기(demister)(자전거용이나 자동차용으로 한정한다),기타의 합성필라멘트사,내연기관용의 점화용 또는 예열용 플러그,유기화학품,혼합하여 냉장하지 않은 당류,의약품,전자응용 기타 기기(예: 적외선 또는 자외선 기기, 자외선 또는 적외선 조사기・오락용 레이저디스크 플레이어 등),아연도금 또는 아연도금 처리한 평판압연제품,산소기 또는 그와 유사한 기기,기타 원동기,기타 합금강의 봉,따로 분류되지 않은 기타의 방직용 섬유제품 및 그 제품(예: 실의 자투리・면의 먼지),방직용 섬유로 만든 기타의 의류,기타,반도체장치,기타의 아황산염과 과아황산염,펄프,가공한 버터와 같은 제품,여과기 또는 정화기,자동차와 그 밖의 자동차차량(제8709호의 것을 제외하며 주로 사람을 수송할 수 있도록 설계된 것에 한한다),합성수지,철강제의 스프링과 그 밖의 스프링제품,탄산수,그 밖의 무기화합물,정류기・변환기・인버터,방직용 섬유로 만든 테이프・태슬・레이스・브레이드・트리밍(trimming)・자수직물 등,탈지분유,사진용 필름(감광한 것으로 한정한다),철강제의 구조물,기타의 선박,전기식 신호기・안전 또는 교통관제 장치,페로아연,기타의 완구,산소기 또는 그와 유사한 기기,자동차나 트랙터용 부분품과 부속품(8701~8705호에 해당하는 차량에

한정),카메라,기타의 의류,기타의 조제 식료품(예: 단맛을 낸 코코아 분말, 조제된 식사류 등),전기식 신호기・안전 또는 교통관제 장치,유선전화기 또는 유선전신기기,평판 디스플레이 패널(예: 액정표시장치, OLED패널 등)

◇ 클러스터 1

유아용 의류와 액세서리(편물제),유아용 의류와 액세서리(편물제),유아용 의류와 액세서리(편물제)

◇ 클러스터 2

대두유와 그 분획물,대두유와 그 분획물,알루미늄광과 그 농축물

◇ 클러스터 3

남자용 또는 소년용의 양복・상・자켓・바지・멜빵바지(bib and brace overalls)・반바지 및 그 밖의 의류(편물제),남자용 또는 소년용의 양복・상・자켓・바지・멜빵바지(bib and brace overalls)・반바지 및 그 밖의 의류(편물제),기타 편물제의 의류

◇ 클러스터 4

망간광과 그 농축물,니켈의 매트(mat), 니켈 산화물의 신터(sinter) 및 그 밖의 중간제품,비누류,금속면(면의 일종으로, 금속을 가느다랗게 만든 것),기타의 인쇄용지(롤 모양이나 직사각형 모양),질소산화물,가공철강,산업용 가스,베릴륨, 크롬, 게르마늄, 바나듐, 갈륨, 하프늄, 인듐, 니오븀, 레늄, 탈륨 등

◇ 클러스터 5

철강제의 구조물과 그 부분품(예: 교량, 철탑, 문 등),철도나 트램웨이용 객차와 화물차(모터를 갖추지 않은 것),인조 필라멘트사(고무나 플라스틱으로 덧씌우거나 이와 결합한 것)

◇ 클러스터 6

하이브리드 자동차,백금과 그 밖의 백금족 금속, 이들의 산화물 및 할로겐화물,발전기 세트(디젤 또는 반디젤엔진 구동)

◇ 클러스터 7

항공기와 우주선,항공기와 우주선

◇ 클러스터 8

농기계,농기계

◇ 클러스터 9

대두,구리광과 그 농축물,제재목,그 밖의 가정용 전기기기,기타 조제 식료품,내연기관 차량,트랙터,유리섬유

-Korea, Spectral

클러스터 0

기계요법용 기기, 마사지용 기기, 심리학적 적성검사용 기기, 오존 흡입기, 산소 흡입기, 에어로졸 치료기, 인공호흡기, 은, 실린더용량이 1,500시시 초과 3,000시시 이하인 것, 이 류에 따로 분류되지 않은 기계류, 전기식 납땜용 기기, 금속이나 서멧의 가열분사용 전기식 기기, 공업용이나 실험실용 전기식 노와 오븐, 알루미늄광과 그 정광, 그 밖의 항공기, 우주선, 서보비틀 발사체, 우주선 발사체

클러스터 1

구리광과 그 정광, 제재목, 부분품, 유아용 의류와 그 부속품, 남성용이나 소년용 오버코트, 카코트, 케이프, 클록, 아노락, 윈드치터, 윈드재킷과 이와 유사한 의류

클러스터 2

도포하지 않은 종이와 판지, 구멍을 뚫지 않은 펀치카드와 펀치테이프지, 수제 종이와 판지, 티타늄과 그 제품, 합성모노필라멘트, 방직용 합성섬유재료의 스트립, 따로 분류되지 않은 조제 식료품, 황산지, 내지지, 트레이싱지, 글라신지, 투명 광택지, 반투명 광택지, 밀과 메슬린, 철이나 비합금강의 그 밖의 봉, 철이나 비합금강의 평판압연제품, 카본지, 셀프복사지, 복사지, 전사지, 축전지, 석유와 역청유, 의약품, 지르코늄과 그 제품

클러스터 3

그 밖의 무기산과 무기 비금속 산화물, 철이나 비합금강의 형강, 그 밖의 호흡용 기기와 가스마스크, 화장지, 안면용 티슈용 원지, 타월, 냅킨용 원지, 가정용 종이, 위생용 종이, 셀룰로오스워딩, 셀룰로오스섬유의 웹, 철이나 비합금강의 봉, 베릴륨, 크로뮴, 하프늄, 레늄, 탈륨, 카드뮴, 게르마늄, 바나듐, 갈륨, 인듐, 니오븀과 그 제품, 니켈의 괴, 농업용, 원예용, 임업용 기계, 잔디용, 운동장용 롤러

클러스터 4

철광과 그 정광, 철이나 비합금강의 평판압연제품, 합성고무, 팩티스, 제4001호의 물품과 제4002호의 물품과의 혼합물, 에틸렌의 중합체, 석탄, 연탄, 조개탄, 고체

연료, 팜유와 그 분획물

클러스터 5

철이나 비합금강의 평판압연제품, 합성필라멘트사, 알루미늄의 괴, 광섬유, 광섬유 다발, 광섬유 케이블, 편광재료로 만든 판, 렌즈, 프리즘, 반사경, 광학소자, 모니터, 프로젝터, 텔레비전 수신용 기기, 실험실용 도자제품, 화학용 도자제품, 공업용 도자제품, 농업용 도자제 통, 물품의 수송용 도자제 항아리, 단지, 한 면이나 양면을 도포한 종이와 판지, 전기식 조명용 기구, 신호용 기구, 윈드스크린와이퍼, 제상기, 제무기, 종이, 판지, 셀룰로오스워딩, 셀룰로오스섬유의 웹, 철이나 비합금강의 그 밖의 봉, 도포하지 않은 종이와 판지, 겹붙인 종이와 판지, 물결 모양 종이와 판지, 주름지 종이와 판지, 구겨진 종이와 판지, 올록볼록한 종이와 판지, 구멍을 뚫은 종이와 판지, 망간과 그 제품, 면

클러스터 6

내과용, 외과용, 치과용, 수의과용 기기, 신티그래픽식 진단기기, 전기식 의료기기, 시력 검사기기, 재생 필라멘트사, 반합성 필라멘트사, 반도체 디바이스, 감광성 반도체 디바이스, 발광다이오드, 압전기 결정소자, 엑스선 기기, 알파선 기기, 베타선 기기, 감마선 기기, 방사선 사진용 기기, 방사선 치료용 기기, 엑스선관, 엑스선 발생기, 고압 발생기, 조절반, 스크린, 검사용 테이블, 치료용 테이블, 의자, 옥수수, 도프처리된 화학원소, 도프처리된 화학화합물, 전동기, 발전기, 전화기, 송신용 기기, 수신용 기기, 불꽃점화식 내연기관의 점화용 전기기기, 압축점화식 내연기관의 점화용 전기기기, 점화용 자석발전기, 점화코일, 점화플러그, 예열플러그, 시동 전동기, 내연기관에 부속되는 발전기, 개폐기, 그 밖의 차량, 석유가스, 가스 상태의 탄화수소, 천연고무, 발라타, 구타페르카, 구아율, 치클, 천연 검

클러스터 7

전기식 즉시식 물가열기, 저장식 물가열기, 투입식 가열기, 난방기기, 토양가열기, 전기가열식 이용기기, 헤어드라이어, 헤어컬러, 컬링통히터, 손 건조기, 전기다리미, 가정용 전열기기, 전열용 저항체, 합성필라멘트사의 직물, 정형외과용 기기, 목발, 외과용 벨트, 탈장대, 골절 치료용 부목, 골절 치료구, 인공 인체 부분, 보청기, 결함 보정기기, 장애 보정기기, 착용, 휴대, 인체 삽입 기기, 원목, 실린더용량이 3,000시시를 초과하는 것, 휴대용 전등, 백금, 그 밖의 차량, 압축점화식 피스톤 내연기관, 추진용 모터, 전동기, 안티모니와 그 제품, 발전세트, 회전변환기, 철강 구조물, 구조물의 부분품, 다리, 교량, 수문, 탑, 격자주, 지붕, 지붕틀, 문, 창, 문틀, 문지방, 셔터, 난간, 기둥, 구조물용 판, 구조물용 대, 구조물용 봉, 구조물용 형재, 구조물용 관, 자주식 철도용 객차, 자주식 화차, 인조필라멘트사, 대두유, 대두유 분획물

클러스터 8

도포하지 않은 크라프트지, 판지, 철도용 기관차, 궤도용 기관차, 차량의 부분품, 대두, 서멧, 면도기, 이발기, 모발제거기, 전기기계식 가정용 기기, 그 밖의 차량, 불꽃점화식 피스톤 내연기관, 추진용 모터, 전동기, 금

-US, KMeans

클러스터 0

Pens, Wine, Buildings, Padlocks, Automatic data processing machines, Sound recording or reproducing apparatus, Reception apparatus for television, Aircraft and spacecraft propellers and rotors, Vehicles with only spark-ignition internal combustion reciprocating piston engine, Wrist-watches and other watches with case of precious metal, Engines for marine propulsion, Vehicles public transport type with only compression-ignition internal combustion piston engine, Cruise ships and similar vessels, Quartz, Copper ores and concentrates, Marble and travertine, Electrical transformers, Seats used for aircraft, Pharmaceutical goods gel preparations, Soya beans, Wool, Fabrics woven of textured polyester filaments, Cases and containers, Silk woven fabrics, Nickel mattes, Flax raw or retted

클러스터 1

Trousers and shorts (men's or boys', cotton), Trousers and shorts (women's or girls', cotton), Propylene copolymers in primary forms, Ivory and animal carving material, Halides and halide oxides of non-metals, Uncoated paper and paperboard, Organic compounds, Alcohols (propan-1-ol, propan-2-ol), Zinc oxide and peroxide, Medicaments for therapeutic or prophylactic uses, Colouring matter of vegetable or animal origin, T-shirts and vests (cotton), Dairy produce natural milk constituents, Vegetable oils (sunflower seed or safflower), Footwear of leather, Tractors single axle, Solvents and thinners, Lubricating oil additives, Sulphides of non-metals, Iron non-alloy pig iron, Alcohols saturated monohydric, Golf clubs, Amine-function compounds, Unsaturated acyclic monocarboxylic acids, Petroleum oils and preparations, Coal bituminous, Pitch and pitch coke, Heterocyclic compounds, Optical fibres, Sodium hydroxide, Ketones, Vinyl chloride polymers, Coal (other than anthracite and bituminous), Medicaments (not containing antibiotics), Nuclear reactors, Gold non-monetary unwrought, Herbicides and plant-growth regulators, Fluorine and bromine, Sulphur, Lignite

클러스터 2

Medicaments containing penicillins or streptomycins, Sugars sucrose, Printed matter trade advertising material, Electric accumulators lead-acid, Salt pure sodium chloride, Footwear waterproof with metal toe-cap, Musical instrument strings, Arms swords and similar, Electronic integrated circuits, Bed linen of cotton, Reception apparatus for television (not designed to incorporate display), Magnesium unwrought, Cereals maize, Hand tools spades and shovels, Fertilizers nitrogenous urea, Tobacco, Meat of swine hams and shoulders, Pharmaceutical goods contraceptive preparations, Chocolate and food preparations containing cocoa, Turbines parts, Stainless steel tubes and pipes, Newspapers and periodicals, Lead unwrought, Zinc unwrought, Wool degreased, Prepared explosives, Dairy produce milk and cream concentrated, Cotton not carded or combed, Microscopes compound optical, Lighters, Dairy produce yoghurt, Optical media recorded, Engravings prints and lithographs

클러스터 3

Jerseys and similar articles of man-made fibres, Overcoats and similar articles for men or boys, Oil seeds rape or colza, Natural cork, Wood windows and frames

클러스터 4

Electric motors and generators, Electrical apparatus switches, Plastics articles, Signalling apparatus, Vehicle gear boxes, Vehicle drive-axles, Vehicle parts and accessories, Paper and paperboard coated with plastics, Sauces and preparations, Meat of swine, Extracts of coffee, Pasta, Dairy produce milk and cream with sugar, Electrical machines and apparatus, Ethylene polymer sacks and bags, Photographic chemical preparations, Musical instrument parts, Sewing thread of synthetic filaments, Plastics sacks and bags, Insulated electric conductors, Rubber pneumatic tyres, Tools rock drilling or earth boring, Machinery parts, Mechanical shovels and loaders, Chemical wood pulp, Electric motors (small), Paper and paperboard cartons, Hinges, Twine and ropes, Plastics plates and sheets, Acrylic polymers, Ethylene polymers, Silicones, Styrene polymers, Propylene polymers, Dyes reactive, Aluminium, Acyclic hydrocarbons, Lead oxides, Particle board of wood, Acetic acid, Aromatic alcohols, Synthetic rubber, Inorganic acids, Hydroxide and peroxide of magnesium, Dairy produce whey, Float glass, Paper coated with kaolin, Petroleum oils crude, Petroleum oils preparations, Newsprint, Wood pulp, Tar, Catalysts, Soap and surface-active products, Rubber tyres, Laminated safety glass, Cigarettes, Refractory ceramic goods, Time switches, Amino-alcohols, Meat of bovine animals boneless, Enzymes, Cement components, Textile fabrics coated, Safety headgear, Buttons and fasteners, Scent sprays, Motorcycles, Electrical static converters, Monumental stone, Copper refined, Boron oxides, Saturated acyclic hydrocarbons, Buttermilk, Methanol, Nickel unwrought, Food preparations for infants, Wood pulp non-coniferous, Manganese oxides, Dairy produce milk and cream concentrated, Blood and antisera, Meat of bovine animals carcasses, Woven pile fabrics, Rice, Artificial body parts, Medicaments with antibiotics, Onions and shallots, Glass ampoules, Single sheet printed matter, Knotted carpets, Aluminium oxide, Outboard motors, Unsaturated ethylene, Chromium oxides, Natural calcium phosphates, Vegetable preparations cucumbers, Data processing units, Bombs and ammunition, Copper tubes and pipes, Iron ores, Graphite, Unsaturated butadiene and isoprene, Warp knit fabrics, Cotton garnetted waste, Rare gases, Nucleic acids, Floating drilling platforms

클러스터 5

Coal gas, water gas, producer gas

클러스터 6

Nickel ores and concentrates, Paper and paperboard registers and notebooks, Photographic cameras, Military weapons, Cigars and cheroots, Furskin articles

클러스터 7

Cruise ships and excursion boats

클러스터 8

Vegetable oils olive oil and its fractions

클러스터 9

Ammonia, Clocks electrically operated, Cobalt oxides, Plans and drawings, Ivory articles

클러스터 10

Activated carbon, Potato preparations, Ceramic tiles, Portland cement, Beer, Mineral and aerated waters, Titanium oxides, Benzene, Tea extracts, Coal tar distillation products, Odoriferous substances, Chlorine, Carbon dioxide, Tungsten, Iron or steel sheet piling, Petroleum bitumen, Iron oxides, Potassium chloride fertilizers, Meat of bovine animals cuts with bone, Coke and semi-coke, Semi-finished iron or steel, Tin unwrought, Long pile fabrics, Transport containers, Acyclic ethers, Toluene, Iodine, Palm oil, Palm kernel oil, Soya-bean oil, Skins and feathers of birds, Non-alcoholic beverages, Dairy produce milk and cream with sugar

클러스터 11

Diagnostic or laboratory reagents, Telephones for cellular networks, Veterinary vaccines, Television and video cameras, Chocolate and food preparations with cocoa, Electrical energy, Rail locomotives powered externally

클러스터 12

Orange juice, Umbrellas, Cocoa beans, Wood tableware

-US, Spectral

클러스터 0

Aluminium, Acyclic hydrocarbons, Lead oxides, Aluminium oxide, Alcohols, Coal, Acids, Chromium oxides, Coke, Ethylene, Titanium oxides, Wine, Soya beans, Wool, Cotton, Iron or non-alloy steel, Coal gas

클러스터 1

Medicaments, Sugars, Printed matter, Electric accumulators, Salt, Footwear, Chocolate, Lead, Manganese oxides, Dairy produce, Zinc, Engines, Nickel, Food preparations, Wood pulp, Optical fibres, Sodium hydroxide, Meat, Tools, Cereals, Fertilizers, Tobacco, Wool, Flax, Nickel mattes, Clocks, Ammonia, Ivory

클러스터 2

Medicaments, Zinc oxide, Alcohols, Organic compounds, Dairy produce, Colouring matter, Footwear, Tractors, Herbicides, Golf clubs, Alcohols, Amine-function compounds, Medicaments, Nuclear reactors, Juice, Umbrellas, Cocoa beans, Fabrics, Lignite, Plans and drawings, Wood

클러스터 3

Printed matter, Vehicles, Aircraft and spacecraft, Copper ores, Pharmaceutical goods, Engines, Vehicles, Cruise ships, Reception apparatus, Automatic data processing machines, Sound recording apparatus, Electrical transformers, Bombs, Graphite, Vegetable oils, Acyclic hydrocarbons, Silk, Cameras, Pharmaceutical goods, Military weapons, Floating or submersible platforms, Cruise ships, Vegetable oils

클러스터 4

Insulated electric conductors, Plastics, Ethylene polymers, Photographic goods, Musical instrument parts, Sewing thread, Plastics, Paper and paperboard, Hinges, Twine, Cement, Tools, Rubber, Electrical machines, Arms, Headgear, Textile fabrics, Scent sprays, Buttons, Oxides of boron, Copper, Electrical static converters, Electronic integrated circuits, Bed linen, Vegetable preparations, Musical instrument strings, Cotton, Meat, Iron ores, Lighters, Microscopes, Skins and parts of birds

클러스터 5

Trousers, Trousers, Uncoated paper and paperboard, Refractory ceramic goods, Time switches, Amino-alcohols, Iron, Sulphides, Lubricating oil additives, Newspapers

클러스터 6

Carbon, Vegetable preparations, Ceramic tiles, Cement, Beer, Waters, Extracts, Oils and products of coal tar, Odoriferous substances, Chlorine, Carbon dioxide, Stone, Iron or steel, Petroleum bitumen, Tungsten, Vegetable oils, Marble, Cyclic hydrocarbons, Ethers, Dairy produce, Cigars

클러스터 7

Electric motors, Electrical apparatus, Paper and paperboard, Vehicle parts, Vehicle parts and accessories, Vehicle parts, Soap, Rubber, Glass, Signalling apparatus, Sauces, Meat, Extracts, Food preparations, Dairy produce, Electric motors, Machinery, Mechanical shovels, Chemical wood pulp, Solvents, Dairy produce, Hydroxide and peroxide of magnesium, Halides, Tar, Catalysts, Steel, Turbines, Glass, Meat, Enzymes, Cigarettes, Carpets, Blood, Units of automatic data processing machines, Iodine, Heterocyclic compounds, Metals, Nucleic acids

클러스터 8

Magnesium, Reception apparatus, Optical media, Dairy produce, Vaccines, Telephones, Reagents, Television cameras, Cobalt oxides

클러스터 9

Motorcycles, Padlocks, Pens, Buildings, Tin, Fabrics, Fabrics, Cases and containers, Paper and paperboard, Nickel ores, Non-alcoholic beverages, Quartz, Containers

클러스터 10

Jerseys, Overcoats, Oil seeds, Cork, Rail locomotives, Chocolate, Electrical energy, Furskin articles, Wood

클러스터 11

Glass, Paper and paperboard, Oils, Petroleum oils, Petroleum oils, Acyclic hydrocarbons, Dairy produce, Wood pulp, Newsprint, Coal, Gases, Natural calcium phosphates, Fertilizers, Ketones, Iron oxides, Vegetable oils, Pitch and pitch coke, Pitch, Fluorine, Sulphur

클러스터 12

Fabrics, Meat, Artificial parts, Medicaments, Cereals, Vegetables, Wrist-watches, Prepared explosives, Dairy produce, Vegetable oils, Seats, Engravings

클러스터 13

Acrylic polymers, Ethylene polymers, Ethylene polymers, Silicones, Styrene polymers, Propylene, Dyes, Plastics, Particle board, Acids, Alcohols, Rubber, Inorganic acids, Cyclic hydrocarbons, Ivory, Propylene, Vinyl chloride, Copper, T-shirts