An Overview of
Space Technology Analysis from Patent Documents

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Contents

- History
- Basic Logic
- Analytical Tools
- Technical Fields
- Number of Patents
- Patent Producers
- Temporal Analysis
- Maturity of Technology
- Matrix Analyses
- TEMPST Analysis
- Technology Development Analysis
- Problem vs Solution Analysis
- Desirably Features in a Patent Analysis Software

History

Dr. Lerson Tanasugarn for MICT

History of Patent Document Analysis

- Developed in industrialized countries
  - USA ?
  - Japan

- Developed for use mainly in the private sector (firm level)
  - undisclosed activities related to technology management in general
  - and to intellectual property management in particular

- Technology Digest by USPTO in the 1980s
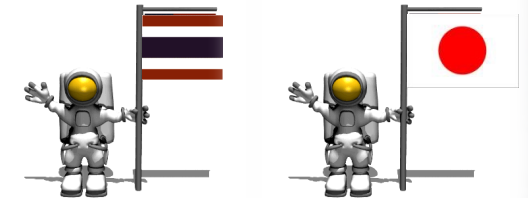
- Not widely know before 1997 (B.E. 2540)

Introducing Pat Analysis into Thailand
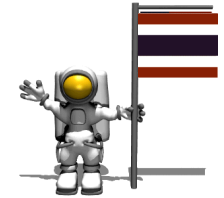
Proposed to analyze patents related to space (but did not know how)

• 1996 MOCT's Space Trip to France

The Japanese Examples

- Japanese speakers from different companies all used the same type of patent analysis
- Saw results but no methodology
- Japanese experts did not want to talk about patent analysis

- 1997 AOTS/JIII Intellectual Property Program

Testing the Methodologies

- Supported by NRCT, ShinSat, & ThaiSat
- Conducted at CU Institute of IP
- Analyses done by hand and EXCEL
- Importance of Expert Opinion

More Recently ....

Toryod.com partially supported by Thailand Research Fund (TRF) to disseminate patent search and analysis techniques

Siam Cement Group of Companies - started to analyze patent documents for technologies and technological trends

# Basic Logic
# of Technological
Analysis

Technological Analysis

Data Access	Data Analysis	Action

Image
Text
-Structured Data
-Unstructured Text

Description
Enumeration
Matrix
Map
Etc.

Policy Direction
-Business
-Financial
-Technical
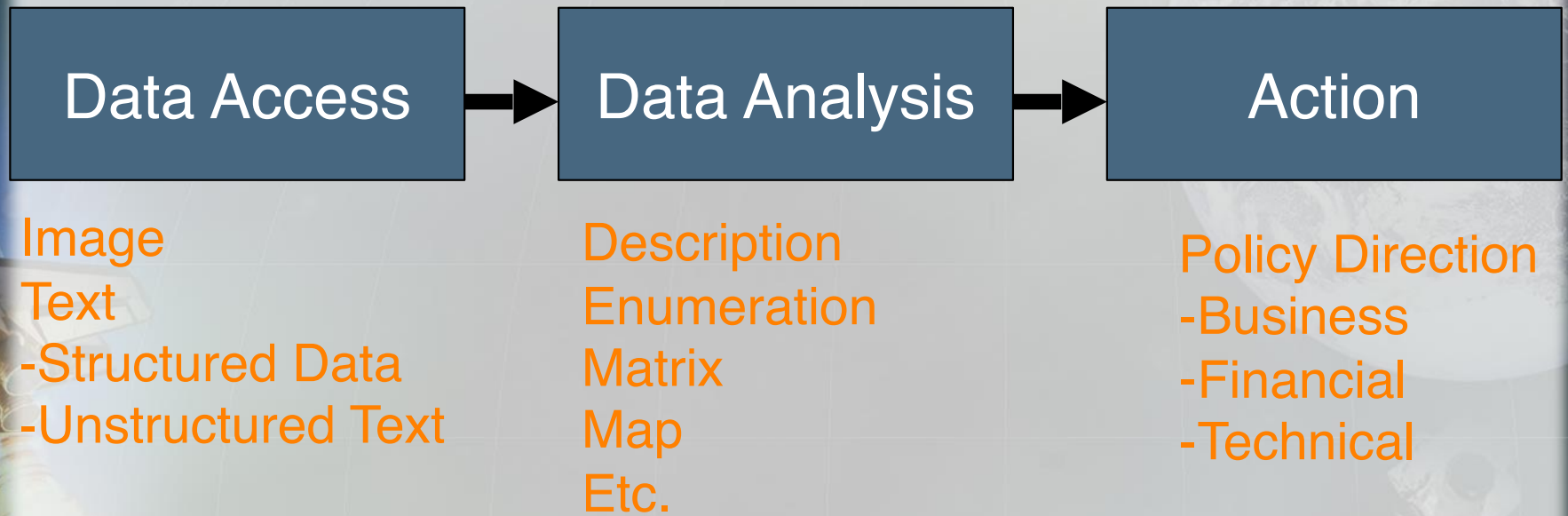
- Data analysis

- Find meaningful results from possibly a lot of data

- Can be viewed as an intermediate step in data preparation for use in decision-making, policy-formulation, etc.

- Derive its usefulness from subsequent actions

Competitive Technological Intelligence

- What are they doing?

- How successful are they and why?

- Who are the key players?

- What is their R&D financial and HR strength?

- What technology, intellectual property or patents do they hold? Who else are holding IP in the industry?

- How are they positioned in the industry?

- What technological trends can we identify?

- Is there a technological niche we can fit in?

- Where can we find a strategic partner?

- Who are their technical brains and how many teams are at work?

- Etc.

Basic Quantitative Analyses
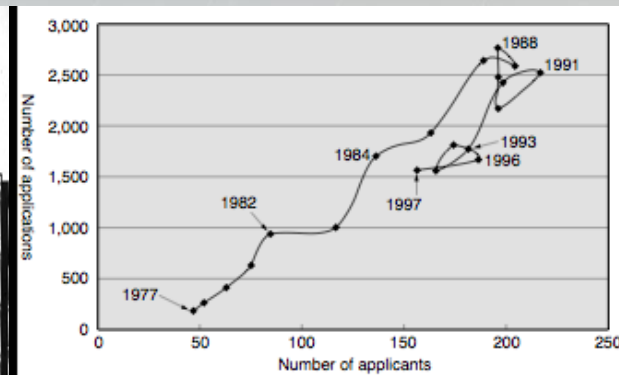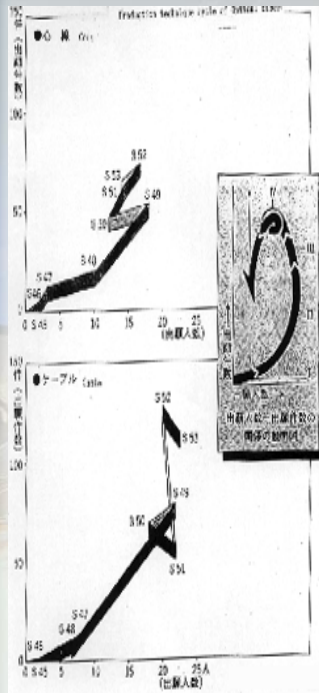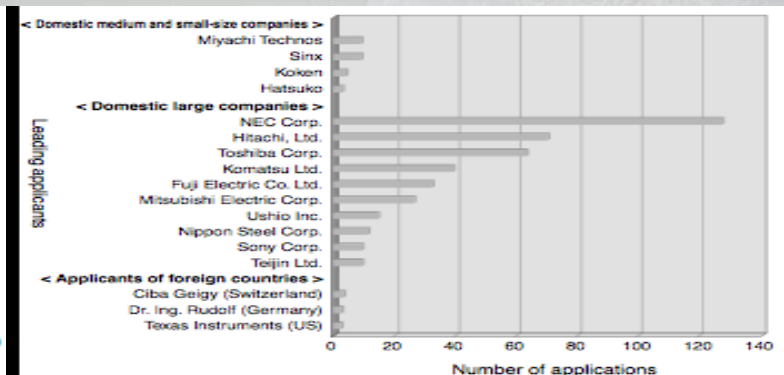
Source: JPO/JIII   Source: JPO/JIII

- Rate Map
- Number Map
- Trend Map
- Relation Map
- Radar Map
- Portion Map
- Etc.
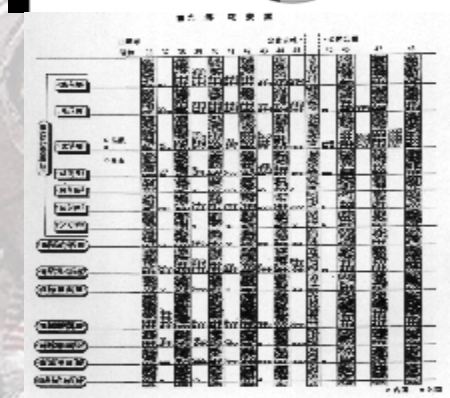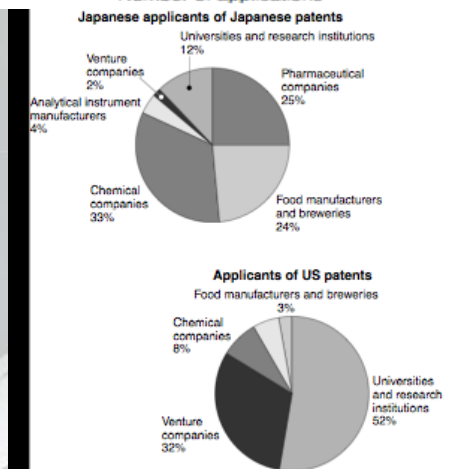
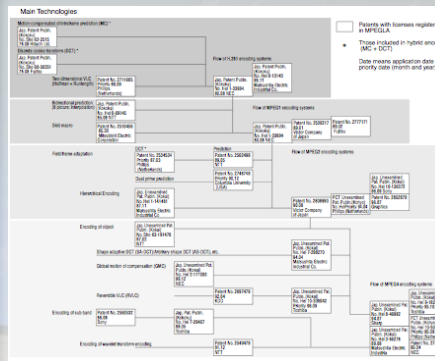# Basic Qualitative Analyses

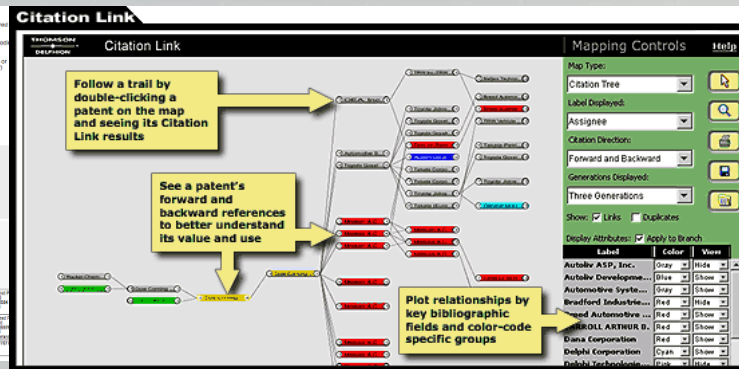Source: JPO/JIII   Source: JPO/JIII

Source: JPO/JIII

- List Map

- Matrix Map

- TEMPST Map
  (Treatment, Effect, Material, Process, Product, Structure)

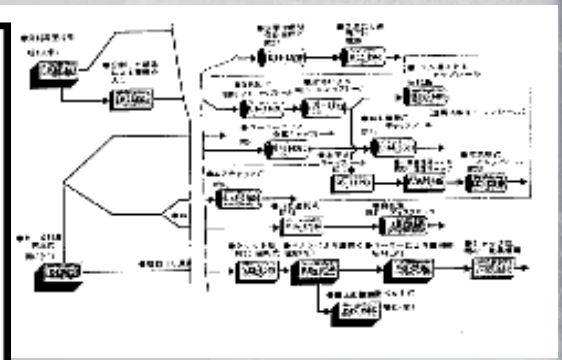- Development Map

- Problems vs Solutions Map

Citation Analysis
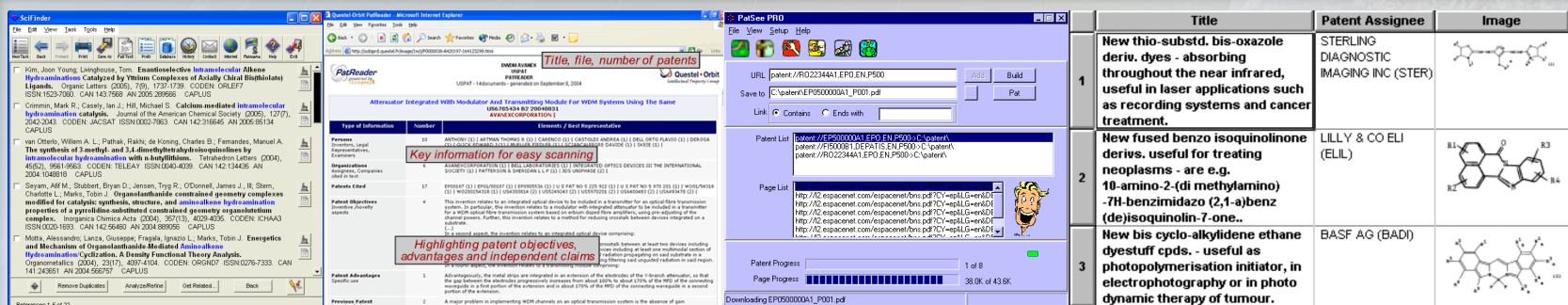

Source: JPO/JIII

Source: Citation Link

Source: JIII

- Forward & backward citation

- Technological progress

- Potential uses and potential licensees

Analytical Tools

Dr. Lerson Tanasugarn for MICT

Patent Info Access, Display & Download

Sci Finder   PatReader   PatSee Pro   BizInt Smart Chart

- Search engine and interface

- Intelligent information display

- Download patent information only
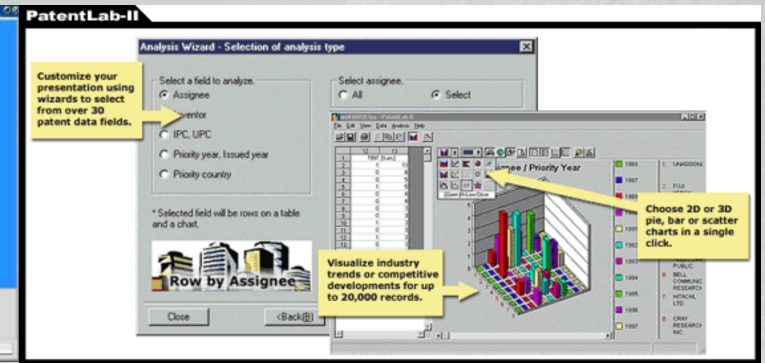
- Format data into structured tables
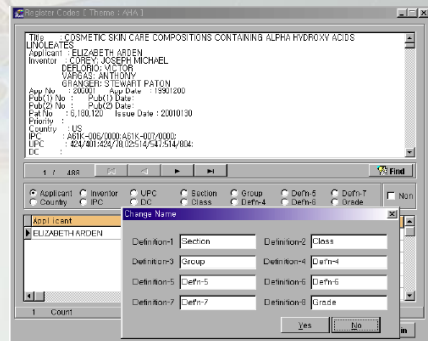
Quantitative/Qualitative S/W
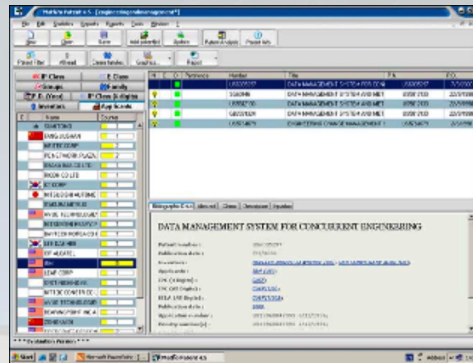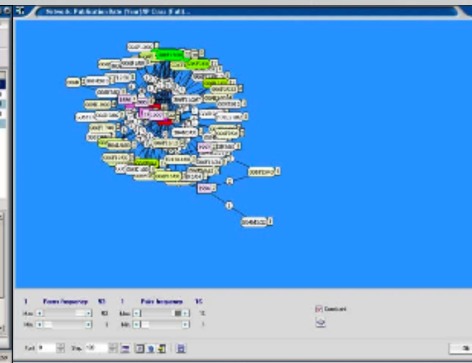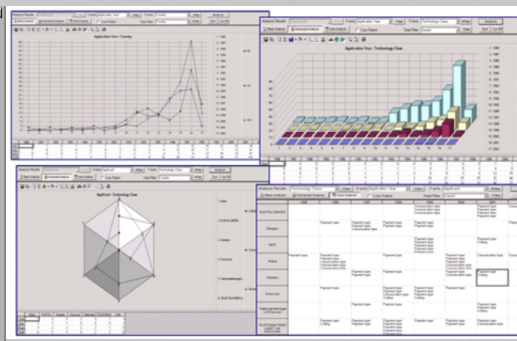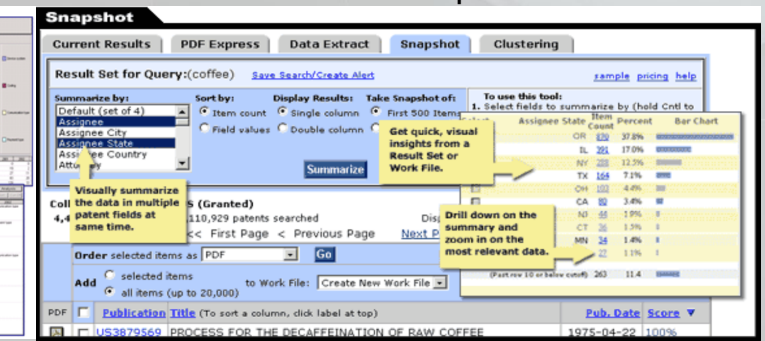

Matheo Patent   Matheo Patent   Delphion's PatentLab II

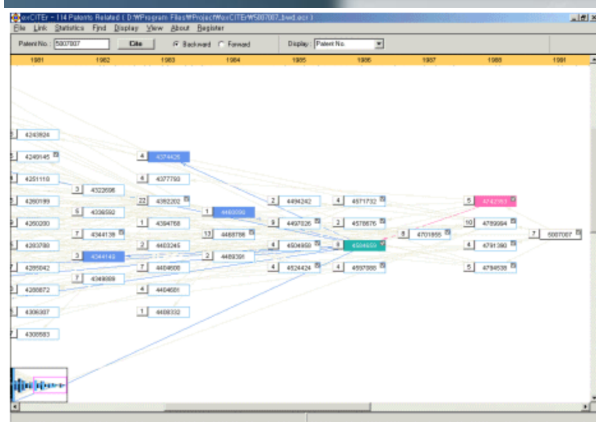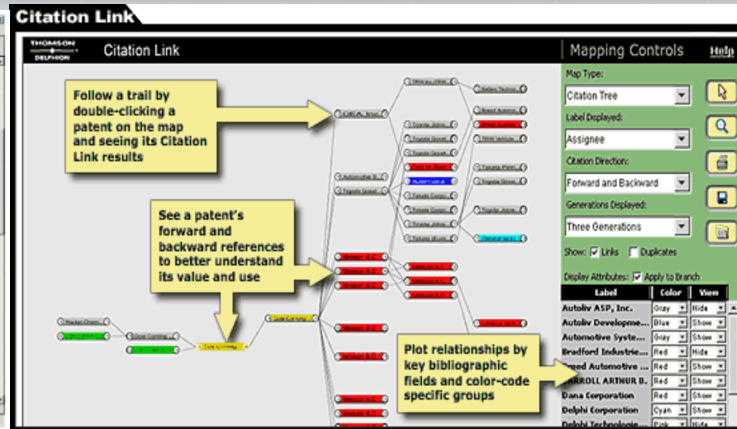INAS   WIPS   Delphion's Snapshot

- Statistical evaluation of data
- Simple relationship of data
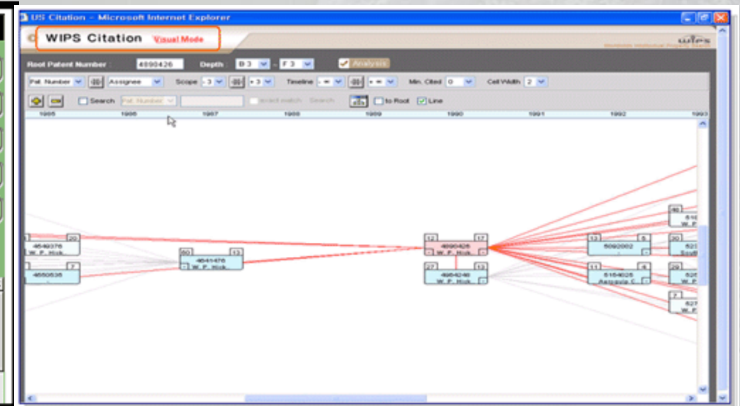- Clustering of data
- Presentation (display)

Citation Analysis S/W

exCITEr

Delphion Citation Link

WIPS Citation
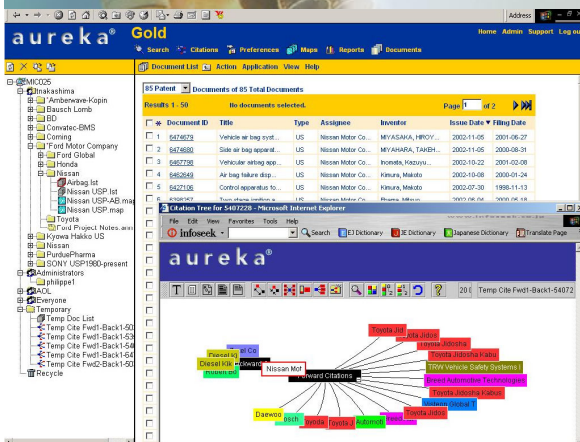
aureka
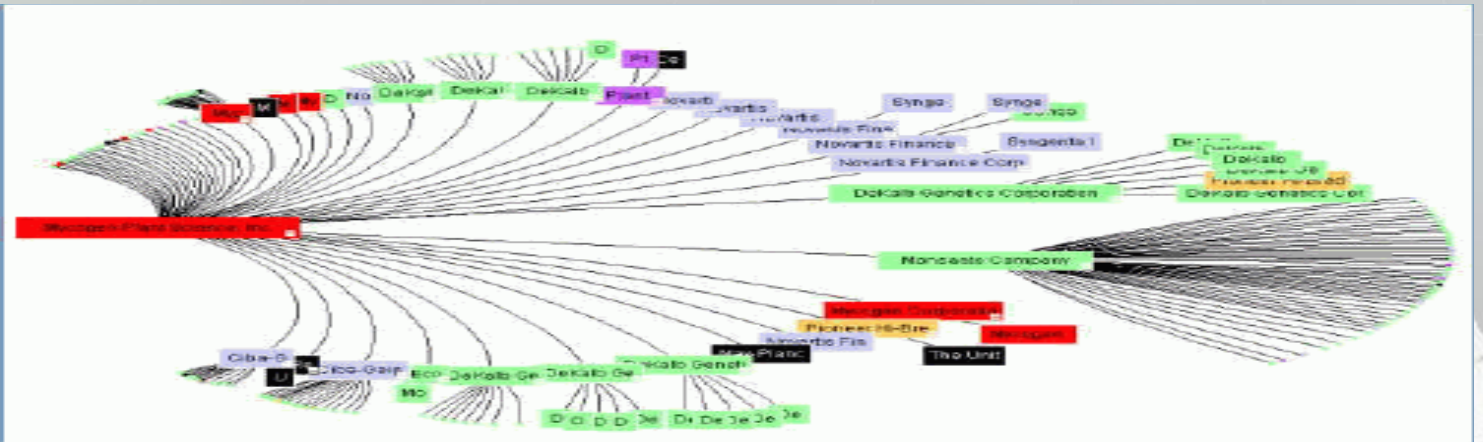
Aureka (Hyperbolic Citation Tree licensed from InXight)

- Forward & reverse references

- Presentation (Display)

- Free web-based citation, e.g. Metrics Group's Citation Bridge

General Data Mining S/W
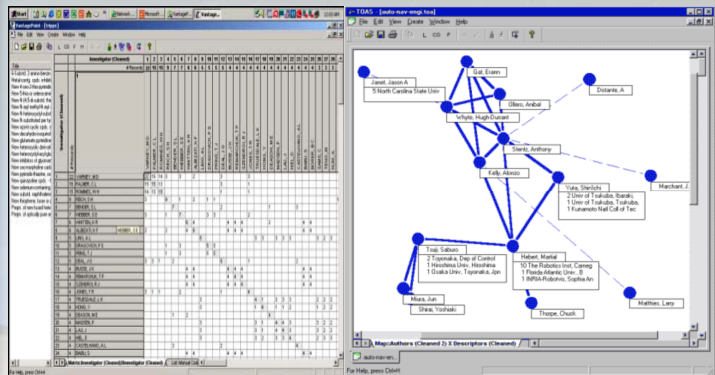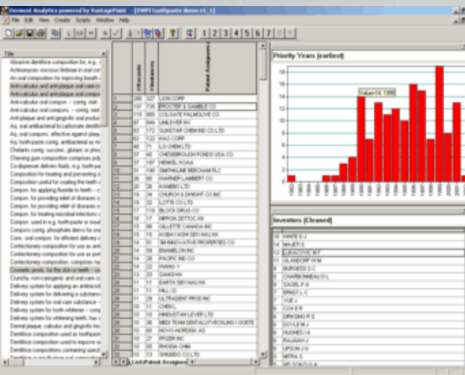
Vantage Point   Derwent Analytics   Anacubis
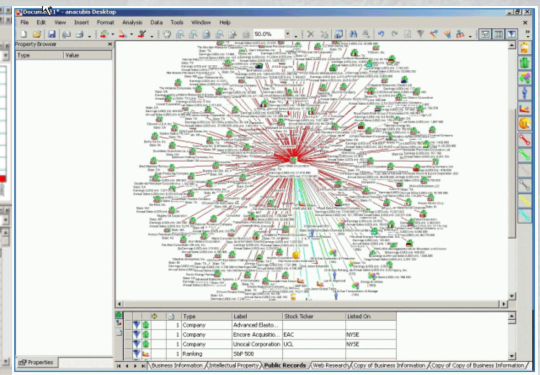
- Matrix & Graphic styles

- Strategic partnership
  (database & data mining s/w)

- Display style
  - Icon (Anacubis)
  - Topography (VxInsight)
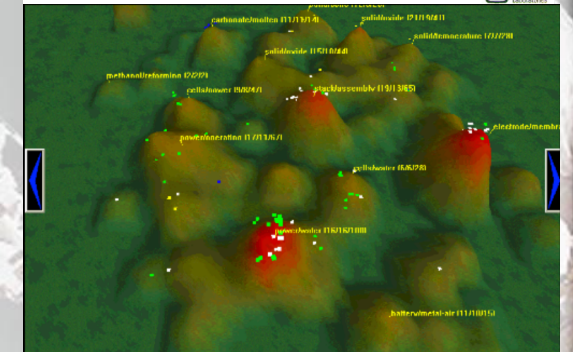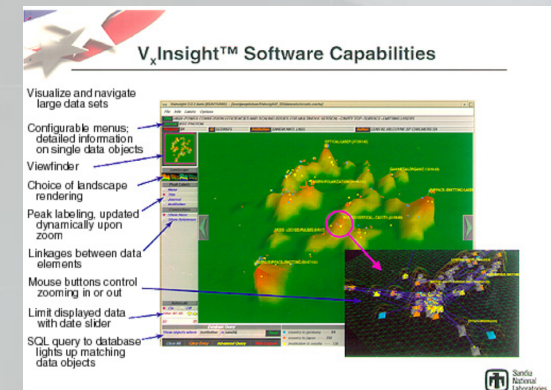
VxInsight

Text Mining S/W (1)
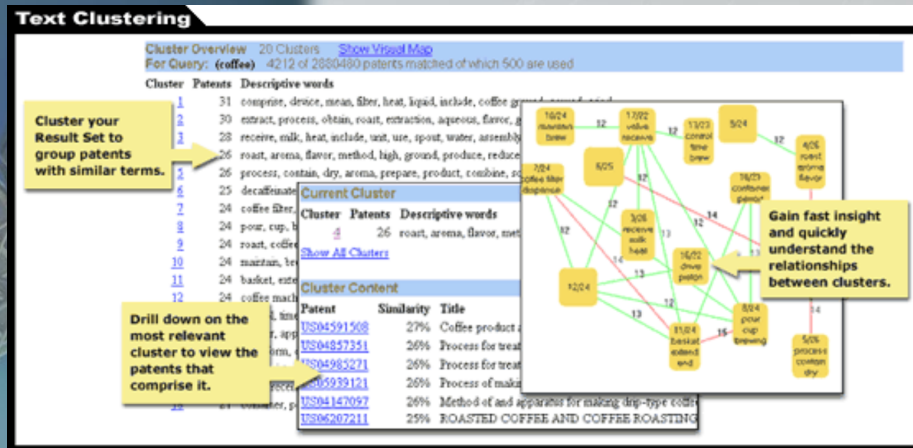
Delphion Text Clustering
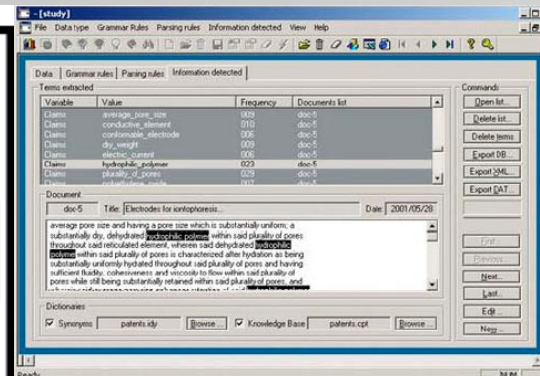
IBM/Synthema
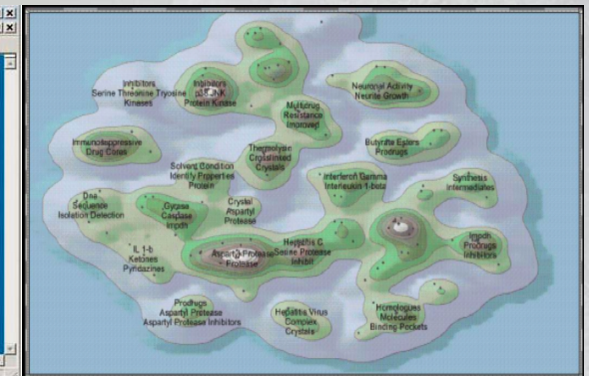
Aureka ThemeScape

ClearForest

- Extraction ->Tagging -> Consolidate with other data -> Display

- Linguistics models Concept mapping Thematic mapping

Text Mining S/W (2)

TEMIS Xelda Multilingual Linguistic Engine
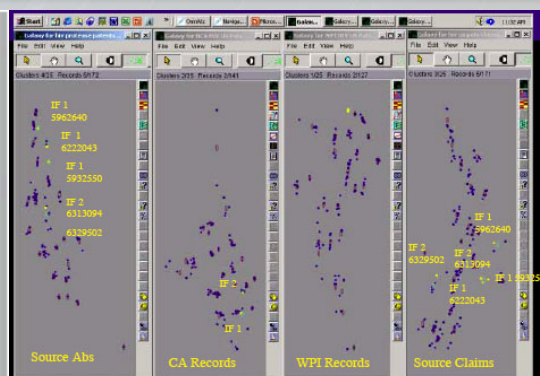
OmniViz
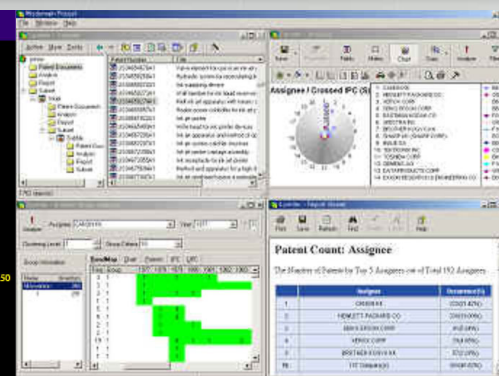
WisDomain Focust
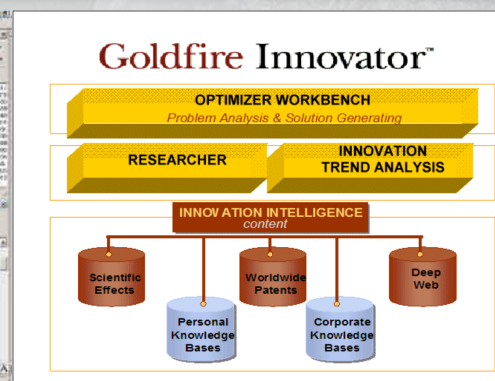
Invention Machine Goldfire Innovator

- Multilingual engine available
- Integration with nonpatent data
  - chemistry & biology (OmniViz)
  - Specialized technology DB (Invention Machine Goldfire Innovator)

Intellectual Property Management S/W

- Aurigin Systems, Inc.
Aureka Intellectual Property Asset
Management (IPAM)
  - Run on corporate server
  - About 1 million baht/year to run
  - Complete suite for management & analysis

- Anaqua, Inc. (web-based)
  - IP asset management
  - Case management
  - Workflow management
  - Case docket & diary management
  - Cost tracking
  - Document generation management

Technical Fields

Dr. Lerson Tanasugarn for MICT

Technical Fields in Attitude Control

- ## Major Fields
    - B64G1/00, 22, 24, 26, 28, 34, 36, 44, 62, COSMONAUTICS; VEHICLES OR EQUIPMENT
    - G05D1/08 SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES
    - B64D EQUIPMENT FOR FITTING IN OR TO AIRCRAFT; FLYING SUITS; PARACHUTES; ARRANGEMENTS OR MOUNTING OF POWER PLANTS OR PROPULSION TRANSMISSIONS

- ## Minor Fields
    - ### Sensor
        - G01B11/26 MEASURING LENGTH, THICKNESS, OR SIMILAR LINEAR DIMENSIONS; MEASURING ANGLES; MEASURING AREAS; MEASURING IRREGULARITIES OF SURFACES OR CONTOURS
        - G01C2/26 MEASURING DISTANCES, LEVELS, OR BEARINGS; SURVEYING; NAVIGATION; GYROSCOPIC INSTRUMENTS; PHOTOGRAMMETRY
        - G01J1/02, 20 MEASUREMENT OF INTENSITY, VELOCITY, SPECTRAL CONTENT, POLARISATION, PHASE OR PULSE CHARACTERISTICS OF INFRA-RED, VISIBLE OR ULTRA-VIOLET LIGHT; COLORIMETRY; RADIATION PYROMETRY
        - G01S5/16 RADIO DIRECTION-FINDING; RADIO NAVIGATION; DETERMINING DISTANCE OR VELOCITY BY USE OF RADIO WAVES; LOCATING OR PRESENCE-DETECTING BY USE OF THE REFLECTION OR RERADIATION OF RADIO WAVES; ANALOGOUS ARRANGEMENTS USING OTHER WAVES
        - F16F15/02 SPRINGS; SHOCK-ABSORBERS; MEANS FOR DAMPING VIBRATION
    - ### Actuator
        - B25J5/00 MANIPULATORS; CHAMBERS PROVIDED WITH MANIPULATION DEVICES
    - ### Control
        - G06F15/50 ELECTRIC DIGITAL DATA PROCESSING
        - G05D1/00 SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

International Patent Classification

IPC4 vs IPC7

Temporal Analysis of Inventions

Electrical System (Manual)

- Chemistry

- Packaging

- Charging

- Regulating
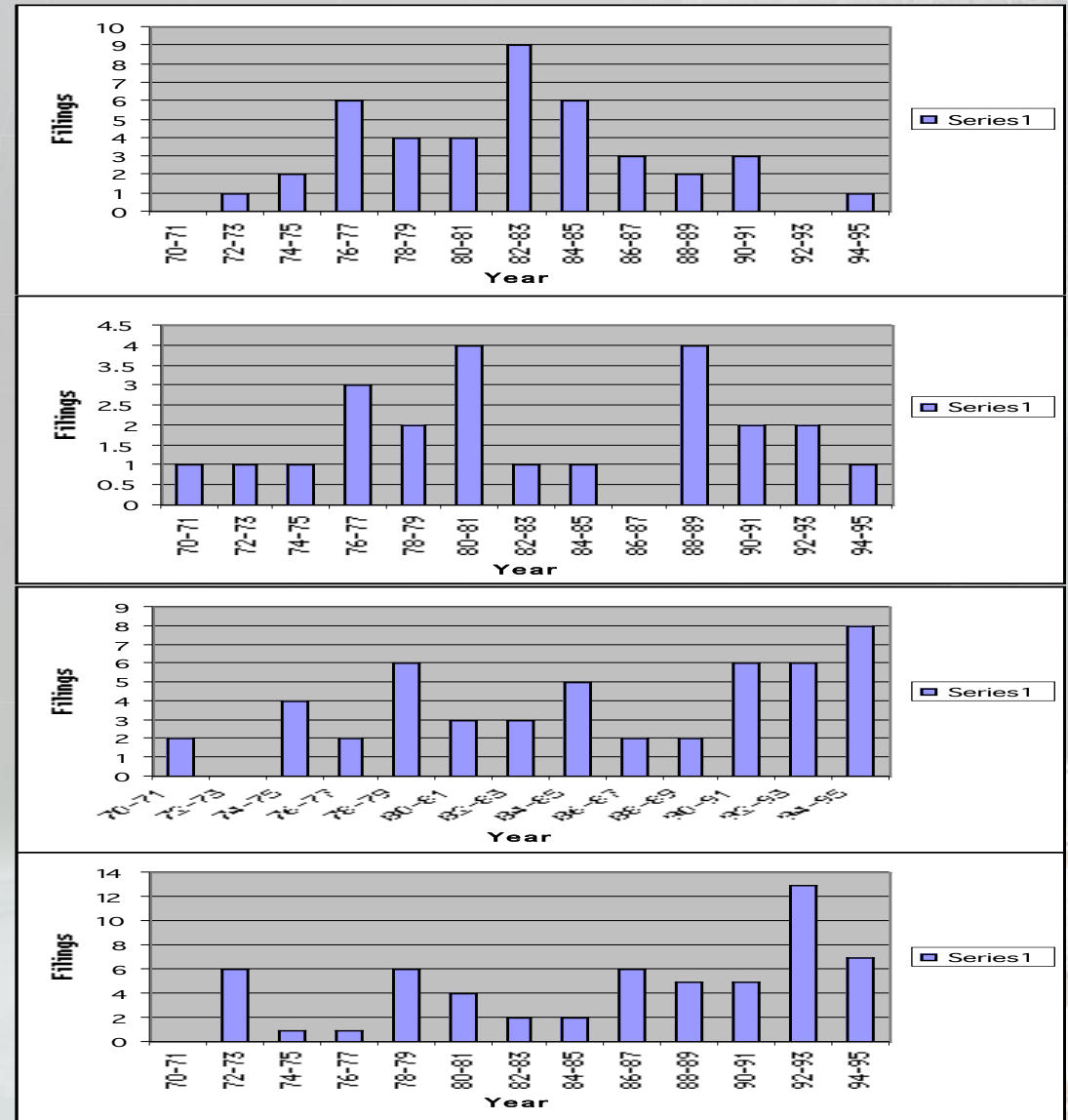
US Patent (1970-1995)

Temporal Analysis

Attitude Control vs Storage/Container/Charging/Regulating Batt.

Another Way of Looking

SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

COSMONAUTICS

MEASURING DISTANCES, LEVELS, OR BEARINGS; SURVEYING; NAVIGATION; GYROSCOPIC INSTRUMENTS; PHOTOGRAMMETRY

- The table and the graphics are from the same dataset.

Maturity
of Technology

Electrical Storage vs Regulation

Storage Maturity — Companies vs Applications in 5 yrs

Regulation Maturity — Applicant vs Applications / 5 yrs
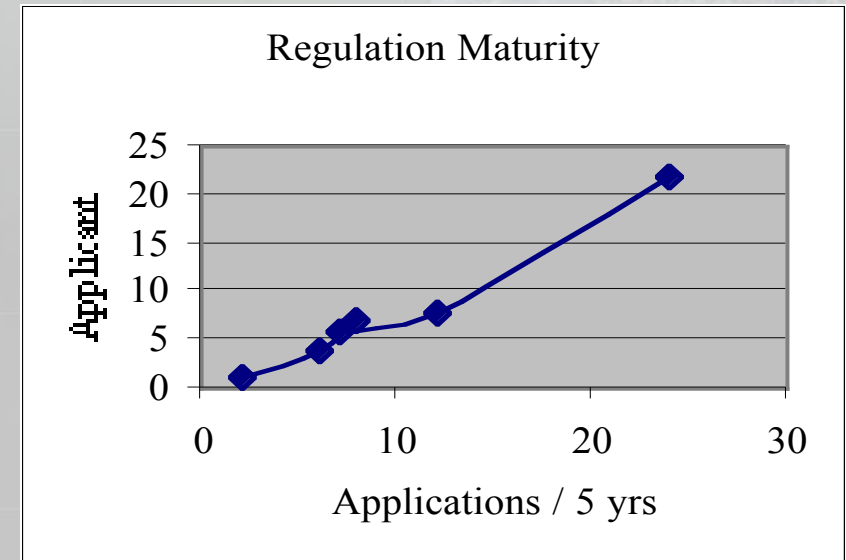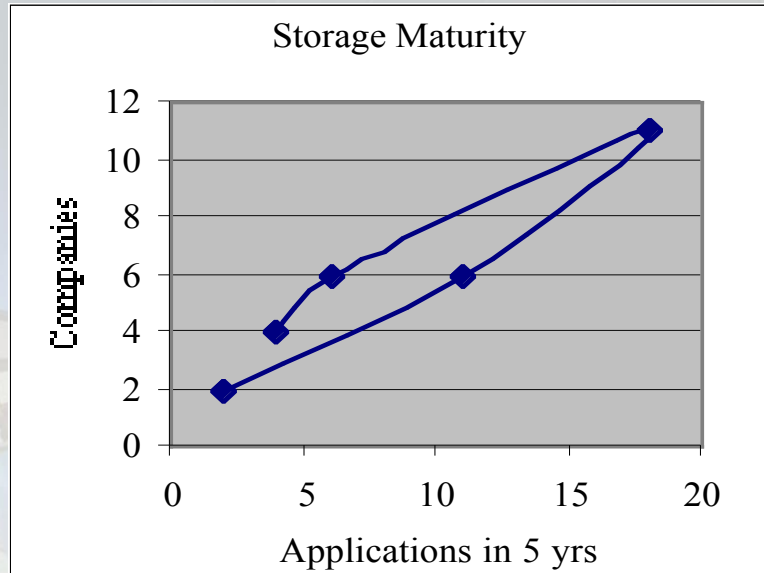
- Looping is seen in matured technologies.
- Growing technology is indicated by a positive slope of the curve

Sources of Invention

Dr. Lerson Tanasugarn for MICT

Inventor, Applicant, and Nationality

Invention in spacecraft attitude control mostly originates in the US. Major US companies are Boeing, Loral Space System, Hughes, RCA, and Honeywell. Etc., Etc.

Expertise Analyses

Corporate Competency

COSMONAUTICS

MEASURING DISTANCES, LEVELS, OR BEARINGS; SURVEYING; NAVIGATION; GYROSCOPIC INSTRUMENTS; PHOTOGRAMMETRY

MANIPULATORS; CHAMBERS PROVIDED WITH MANIPULATION DEVICES

SYSTEMS FOR CONTROLLING OR REGULATING NON-ELECTRIC VARIABLES

MEASUREMENT OF INTENSITY, VELOCITY, SPECTRAL CONTENT, POLARISATION, PHASE OR PULSE CHARACTERISTICS OF INFRA-RED, VISIBLE OR ULTRA-VIOLET LIGHT; COLORIMETRY; RADIATION PYROMETRY

Column headers (left to right):
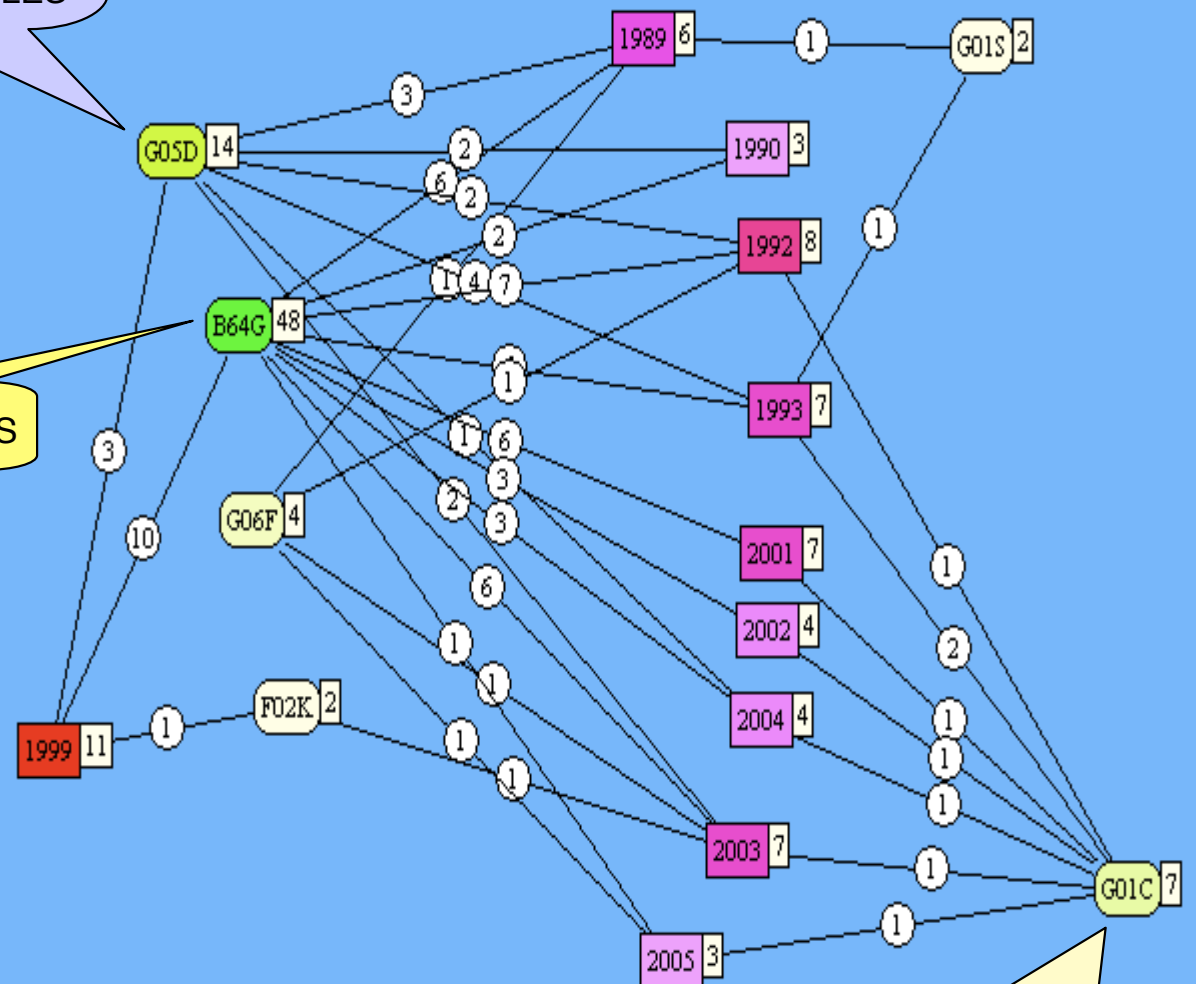BOEING CO (US); [UV...]; WE BON...; ASTRIUM SAS...; HONEYWELL INT INC; LOCKHEED CORP (US); LORAL SPACE SYSTEMS; TOKYO SHIBAURA ELEC; HUGHES ELECTRONICS; RAYTHEON CO (US); HONEYWELL INC (US); BRISTOL AEROSPACE LTD (CA); MAKEEVA (--); G RAKETNYJ TS KB IM AKAD VP (--); MITSUBISHI ELECTRIC CORP (--); KA VP MAKEEVA (--); G RAKETNYJ TS KB IM AKADEMI (--); LOMANOV APOLLON ANATOL EVCH (--); LASER COMMUNICATIONS INTERNATI (US); ICO SERVICES LTD (GB); A VP MAKEEVA (--); G RAKETNYJ TS KB IM AKADEMIK (--); DAIMLER BENZ AEROSPACE AG (DE); MESSERSCHMITT BOELKOW BLOHM (DE); HUGHES AIRCRAFT CO (US); GEN ELECTRIC (US); BRITISH AEROSPACE (GB); BRITISH AEROSPACE (--); FORD AEROSPACE CORP (US); KONTORABESU IT SPA (--); ITHACO (US); RCA CORP (--); HAWKER SIDDELEY DYNAMICS LTD (--); PHILIPS CORP (--); NASA (--); JAPAN SPACE FORUM (--); NAT SPACE DEV AGENCY (--); WEL RES CO LTD (--); SPACE ENGINEERING DEV CO LTD (--); TRW INC (US); HONEYWELL INT INC (US); FORD AEROSPACE CORP (--)

Row values:

- **G06F**: HUGHES AIRCRAFT CO (US) = 1; GEN ELECTRIC (US) = 1
- **B64G**: BOEING CO (US) = 5; HONEYWELL INT INC = 1; LOCKHEED CORP = 1; LORAL SPACE SYSTEMS = 1; (next) = 6; TOKYO SHIBAURA = 2; HUGHES ELECTRONICS = 2; RAYTHEON = 1; BRISTOL = 1; MAKEEVA = 1; G RAKETNYJ = 1; MITSUBISHI = 1; KA VP = 1; G RAKETNYJ = 1; LOMANOV = 1; LASER COMM = 1; ICO = 1; A VP = 1; G RAKETNYJ = 1; DAIMLER BENZ = 2; MESSERSCHMITT = 1; HUGHES AIRCRAFT = 2; GEN ELECTRIC = 5; BRITISH AEROSPACE = 2; BRITISH AEROSPACE = 1; FORD AEROSPACE = 1; KONTORABESU = 1; ITHACO = 1; RCA CORP = 2; JAPAN SPACE FORUM = 1; NAT SPACE DEV = 1; WEL RES = 1; SPACE ENGINEERING = 1; TRW INC = 1; FORD AEROSPACE = 1
- **G01C**: BOEING = 2; HONEYWELL INT INC = 1; BRISTOL = 1; HUGHES AIRCRAFT = 1; BRITISH AEROSPACE = 1; BRITISH AEROSPACE = 1; HAWKER SIDDELEY = 1
- **G05D**: BOEING = 2; HONEYWELL INT INC = 1; LORAL = 1; TOKYO SHIBAURA = 1; BRISTOL = 1; G RAKETNYJ = 1; A VP MAKEEVA = 1; HUGHES AIRCRAFT = 1; BRITISH AEROSPACE = 1; BRITISH AEROSPACE = 2; FORD AEROSPACE = 1; KONTORABESU = 1; FORD AEROSPACE (--) = 1
- **B64D**: [UV...] = 1; WE BON... = 1
- **B25J**: BRISTOL = 1; HONEYWELL INT INC (US) = 1
- **F16C**: BRISTOL = 1
- **G01P**: HUGHES AIRCRAFT = 1
- **G01S**: HUGHES AIRCRAFT = 1; BRITISH AEROSPACE = 1
- **G01B**: BRITISH AEROSPACE = 1; BRITISH AEROSPACE = 1
- **B64C**: HUGHES AIRCRAFT = 1
- **B64B**:
- **G01D**: PHILIPS CORP = 1
- **G01J**: NASA = 2
- **F16F**: JAPAN SPACE FORUM = 1; NAT SPACE DEV = 1; WEL RES = 1; SPACE ENGINEERING = 1
- **F03H**: BOEING = 1

Expertise of Inventors

Corporate Directions

- Spacecraft Electrical Storage System
- 1=batteries, 2=housing, 3=charging, 4=regulation

Personnel Intelligence

Corporate Affiliation of Inventors
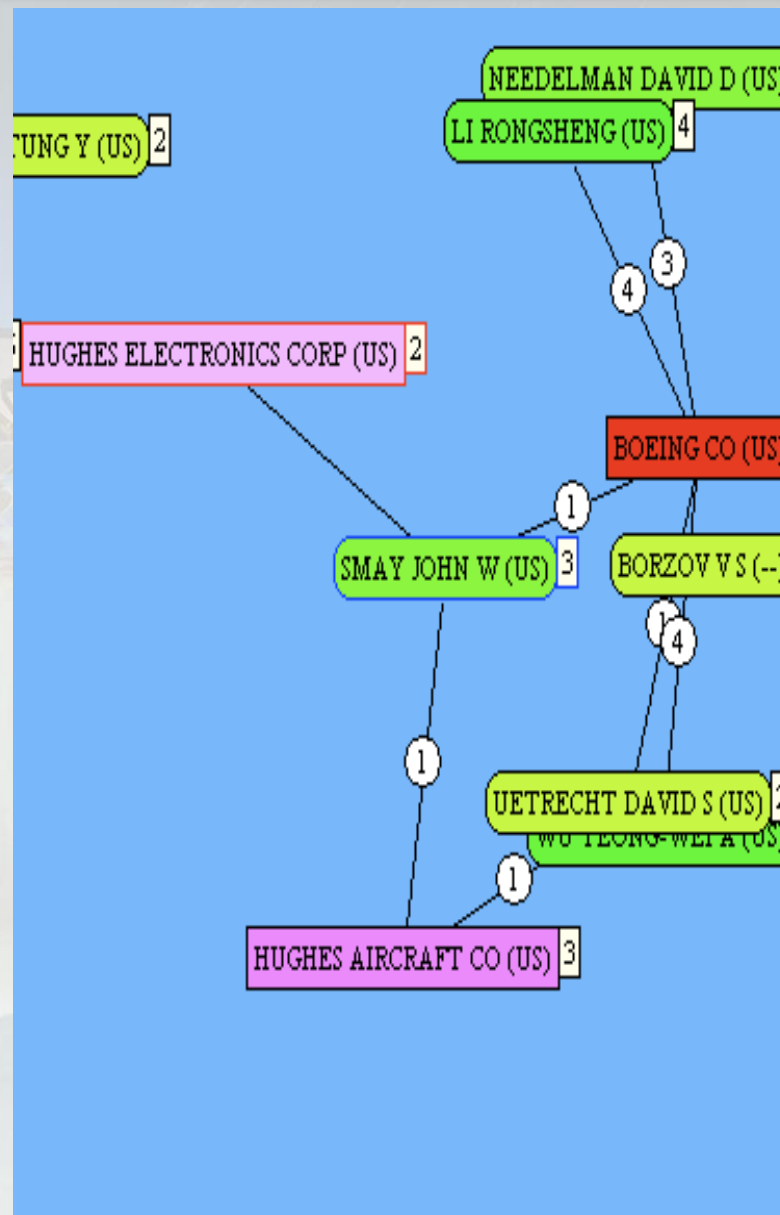
- Network Graphics (Matheo)
- Applicant vs Inventor
- Who is John W. Smay? Why did he invent for Boeing, Hughes Aircraft, and Hughes Electronics?

Colleagues
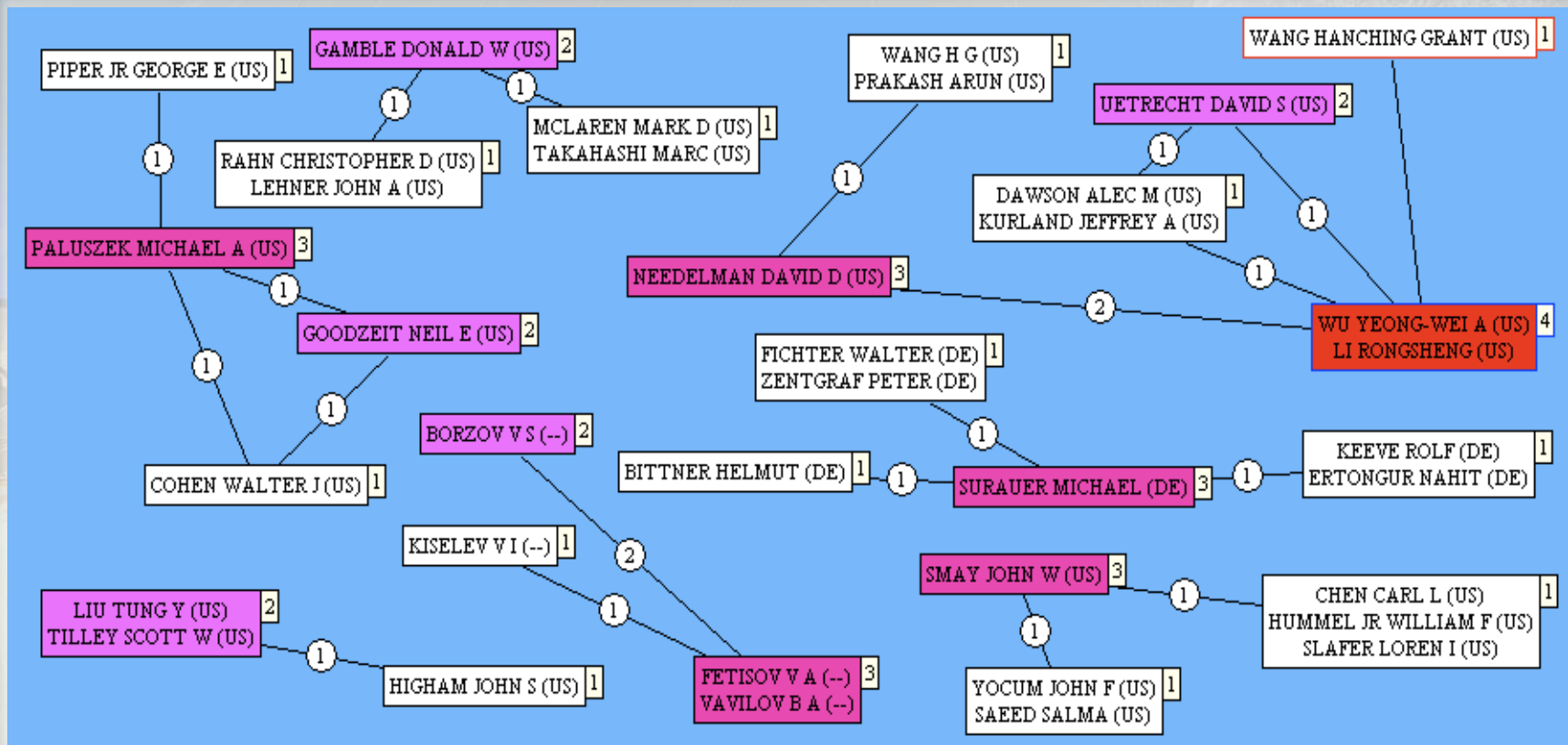
- Who works with whom?

DesirableFeatures (and what to do) in developing a Patent Analysis S/W

Dr. Lerson Tanasugarn for MICT

Overall

- Modular approach & concurrent development
- Participation of CS and AI specialists
- Benchmark package for each module
- Freely useable in Thailand
- Work with free and paid databases
- Multi-platform or even web-based
- Usable in areas with low-bandwidth Internet
- User may pause and resume at any time
- User-friendly, with on-line guides and tutorials for novices
- Script-based in order to update an analysis easily
- Sustainable development, with well-documented source codes and perpetual maintenance scheme

Data Access

- Work with free and paid databases
- Usable in areas with low-bandwidth Internet
- Ability to pause and resume while accessing data
- Option to pre-select patents before actual loading of abstracts and full-text files
- Warning for bulk download blacklist
- Accurate prediction of download time
- Generation of adobe (acrobat) patent files
- Flexible ways of tabulating downloaded patents with several import/export formats

Data Manipulation & Analysis

- Pre-programmed analyses (e.g. Matheo)

- Matrix and Graphics

- 3D Matrix

- 3D Maps to visualize overlapping data

- Flexible and open-ended patent exclusion criteria

- Comprehensive list of patent maps to choose from (about 30-50 types)

- Research to resolve the patent family dilemma

Patent Citations

- Forward & backward

- Check for public-domain patents

- Research novel display schemes

- Flexible patent exclusion criteria

- Convenient extraction of assignee or applicant names and background information
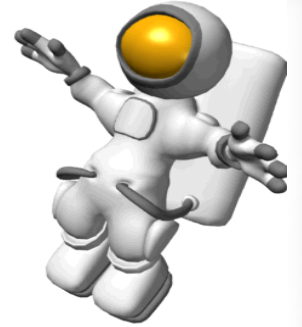
Text Mining

- Collaboration with AI (natural language) academics

- Participate in international patent search technology forums

- Linguistic analysis of textual data for tagging

- Grouping (segmentation) of records according to tagged data

- Explore novel technologies such as neural network models

Presentations

- Explore 3D landscape algorithms
- Graphics for relationship analysis can be rotated in 3D in order to visualize overlapping data and can be saved as movies
- Option for virtual reality (e.g. with stereo display goggles)
- Ability to add textual annotation in English and Thai

Thank You