Yetenekli Veri Analizi (YVA) -
Intelligent Data Analysis (IDA)

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YVA ...

- ... verilerin etkili analizine ilişkin disiplinler arası bir çalışma;
- ... Sürekli akan verinin büyük miktarlarından faydalı bilgileri ayıklamak için kullanmak;
- Mevcut veritabanlarından arzu edilen bilgileri veya ilginç kalıpları çıkarmak;
- Verilerden anlam çıkarma tekniği.

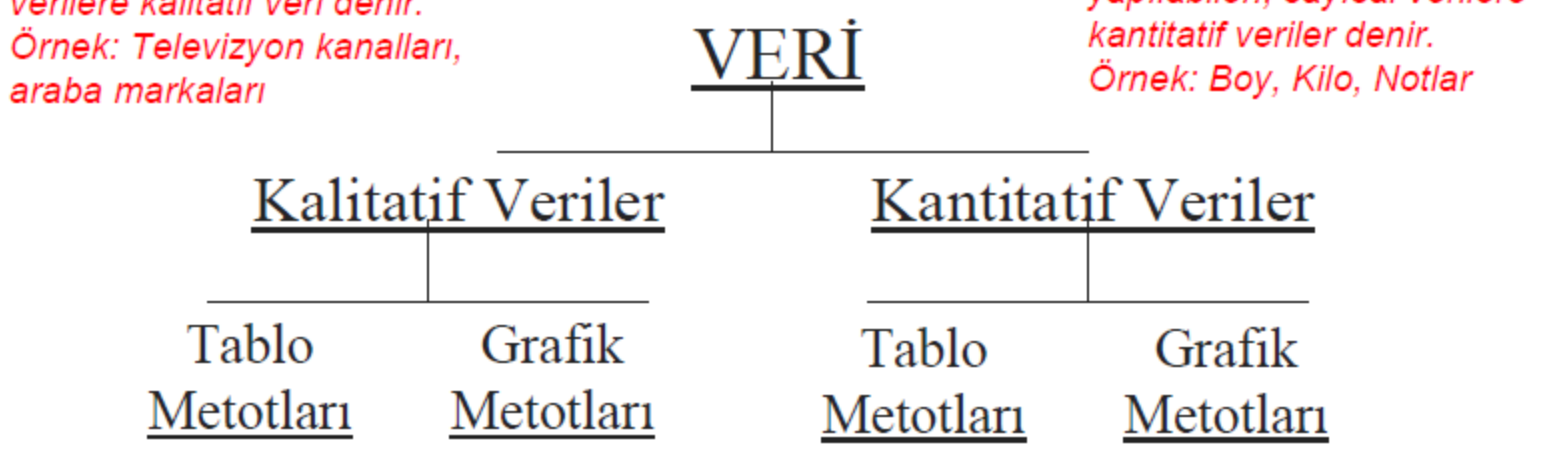
Verilerden anlam çıkarma tekniği

- Problemi ana soruna inerek incelemeye başlarsanız, daha açık bir şekilde görebilirsiniz.
- Basitleştirdiğiniz problem, başladığınız probleme benzemeyecektir; başlangıç problemini tamamen çözünceye kadar küçük düzeltme ya da eklemelerle çözüme gitmeye devam edeceksiniz.
- Farklı alan ya da disiplinler arasında bağlantılar bulmaya çalışın.
- Bakış açını değiştir… Problemde belli bakış yöntemlerine yönelten düşünce bloklarından kendini kurtar.
- Yapısal analiz, zorlu bir problemi küçük parçalara ayırma işlemidir. Matematikte çoğu ispat oldukça fazla dolambaç içeren bir süreçle ortaya çıktı…bir teoremi ispatlamaya başlayan birisi özünden sapmış bir şekilde birçok yol dolaşarak çözüm arar. Herhangi bir şey için temel oluşturmayan bir çok sonuç elde eder ve en sonunda verilen probleme yönelik sonucu bulur.
- Geri analiz (Retrograde analysis)' ve 'geriye dönük çözüm
- Problemi çözdüyseniz, çözümü gidebildiği noktaya kadar uzatın
- Motivasyon…çözümü elde etmek için bir çeşit arzu, seni neyin çalışmaya ittiğini bilme arzusu…eğer bunlar sende yoksa, dünyada tüm pratik bilgi ve zekaya sahip de olsan, çözümü bekleyen soruların olmaz , cevaplara ulaşamazsın

Verilerin Organizasyonu

Tek bir etiketle tanımlanabilen verilere kalitatif veri denir. Örnek: Televizyon kanalları, araba markaları

Üzerinde dört işlem yapılabilen, sayısal verilere kantitatif veriler denir. Örnek: Boy, Kilo, Notlar



Verileri anlamlı hale getirme

- Sözel ifadeler ile açıklama
- Yazısal betimleme
- Tablo, grafik
- Veriler değerlendirilerek istatistiksel ölçüler bulma
- Matematiksel modeller oluşturma

YVA uzmanlığa dayalı bilgi aktarır…

IDA or …

- Data mining
- Knowledge acquisition from data
- Genetic algorithm-based rule discovery
- Knowledge discovery
- Learning classifier system
- Machine learning
- etc.

Tecrübeye dayalı bilgi - Knowledge

- *Knowhow: pratik bilgi veya beceri; Uzmanlık.*
- toplanan, sınıflandırılan, organize edilen, entegre edilmiş, soyutlanmış ve katma değeri olan bilgilerin damıtılması;
- veriden daha yüksek bir soyutlama seviyesinde ve yeni bilgi ve yeni deneyimler çıkarmak için kullanılabilecek bilgiler;
- genellikle problem çözmede uzmanlık

Why do we analyze data?

The purpose of analyzing data is to obtain usable and useful information. The analysis, irrespective of whether the data is qualitative or quantitative, may:

- describe and summarized the data
- identify relationships between variables
- compare variables
- identify the difference between variables
- forecast outcomes

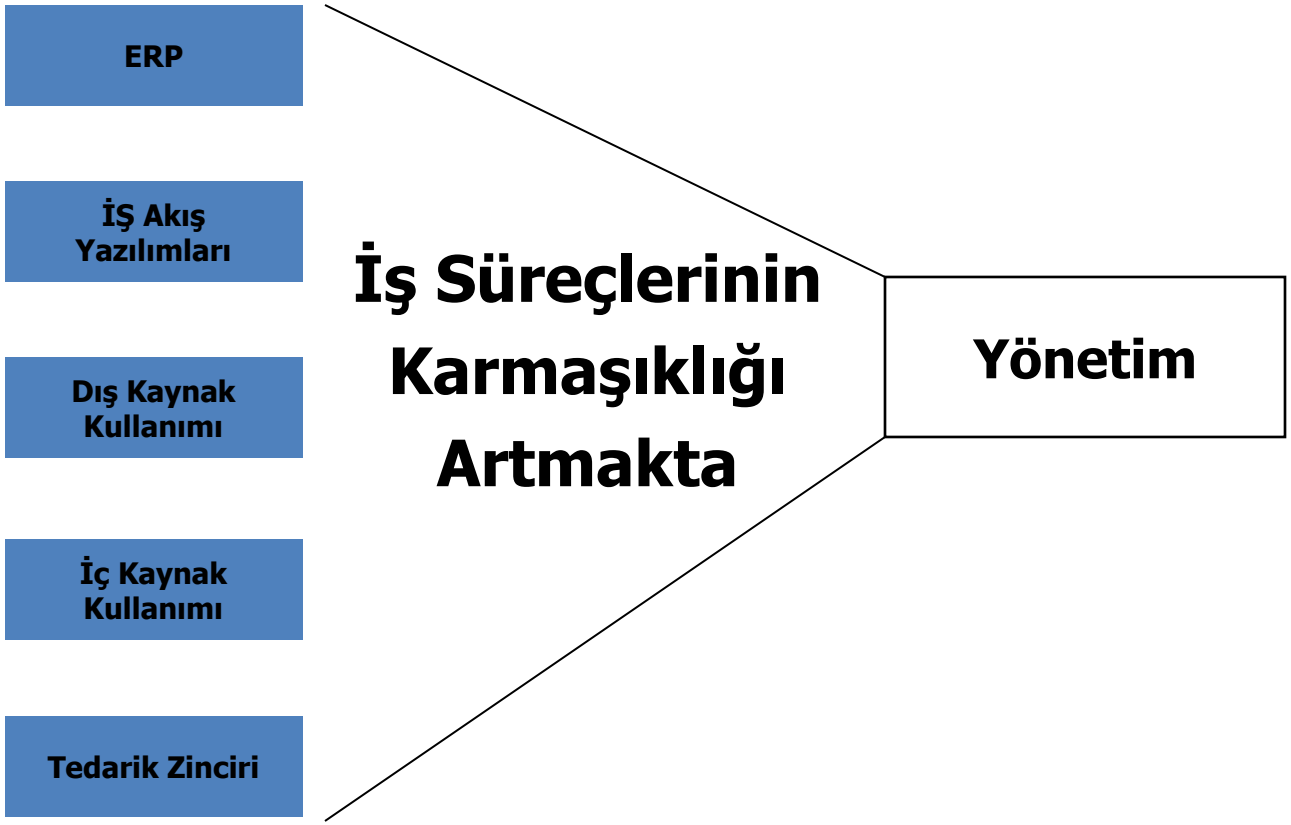
Knowledge acquisition …

- *Bilgiyi ortaya çıkarma, analiz etme, dönüştürme, sınıflandırma, organize etme ve bütünleştirme ve bu bilgiyi bir bilgisayar sisteminde kullanılabilecek bir biçimde temsil etme süreci.*

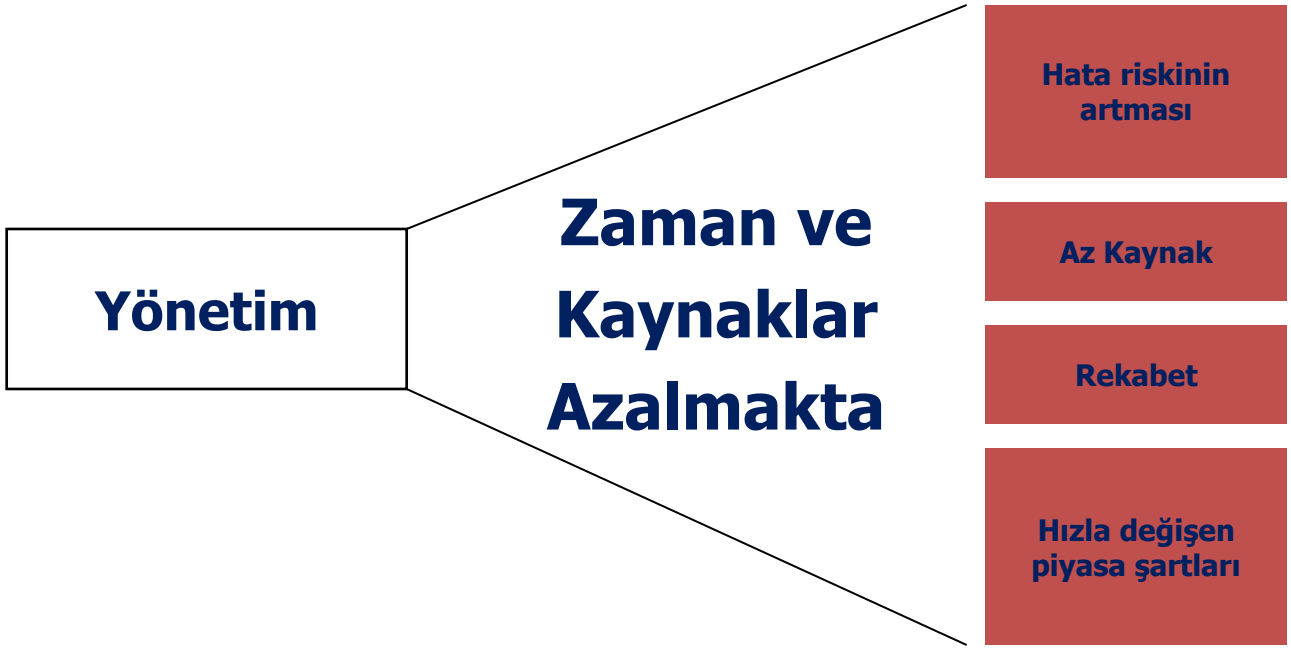
Tecrübeye dayalı bilgi - Knowledge

- *Knowhow:pratik bilgi veya beceri; Uzmanlık.*
- *the distillation of information that has been collected, classified, organized, integrated, abstracted and value-added;*
- *at a level of abstraction higher than the data, and information on which it is based and can be used to deduce new information and new knowledge;*
- *usually in the context of human expertise used in solving problems.*
- toplanan, sınıflandırılan, organize edilen, entegre edilmiş, soyutlanmış ve katma değer verilen bilgilerin damıtılması;
- veriden daha yüksek bir soyutlama seviyesinde ve yeni bilgi ve yeni deneyimler çıkarmak için kullanılabilen ve dayandırılan bilgiler;
- genellikle problem çözmede kullanılan uzmanlık

Değişen Çerçeve



Değişen Çerçeve



Değişen Çerçeve

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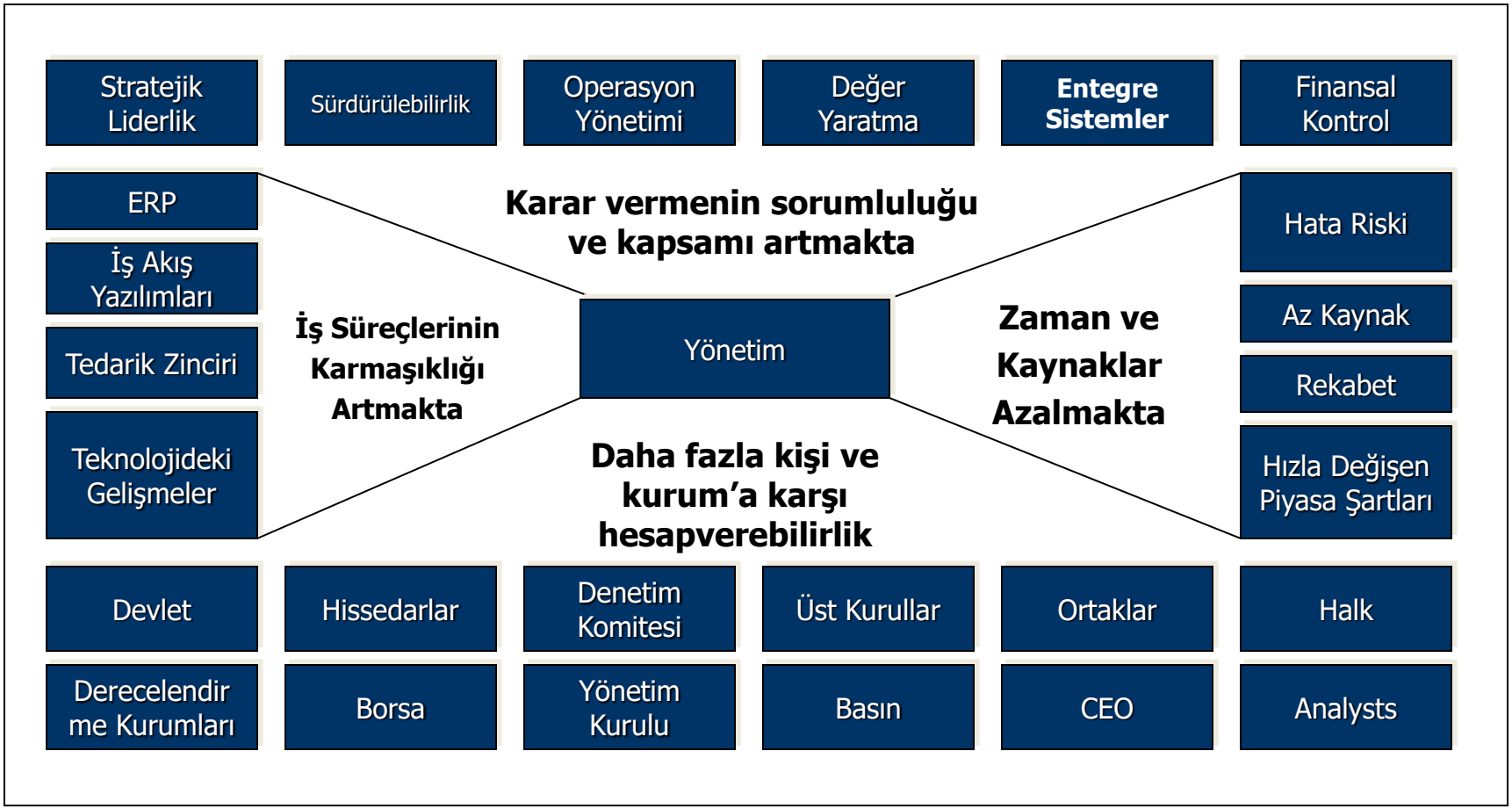

Stratejik Liderlik
Sürdürülebilirlik
Operasyon Yönetimi
Değer Yaratma
Entegre Sistemler
Finansal Kontrol
ERP
İş Akış Yazılımları
Tedarik Zinciri
Teknolojideki Gelişmeler
Karar vermenin sorumluluğu ve kapsamı artmakta
İş Süreçlerinin Karmaşıklığı Artmakta
Yönetim
Zaman ve Kaynaklar Azalmakta
Daha fazla kişi ve kurum'a karşı hesapverebilirlik
Hata Riski
Az Kaynak
Rekabet
Hızla Değişen Piyasa Şartları
Devlet
Hissedarlar
Denetim Komitesi
Üst Kurullar
Ortaklar
Halk
Derecelendirme Kurumları
Borsa
Yönetim Kurulu
Basın
CEO
Analysts

Değişimi Etkileyen Teknolojik Faktörler

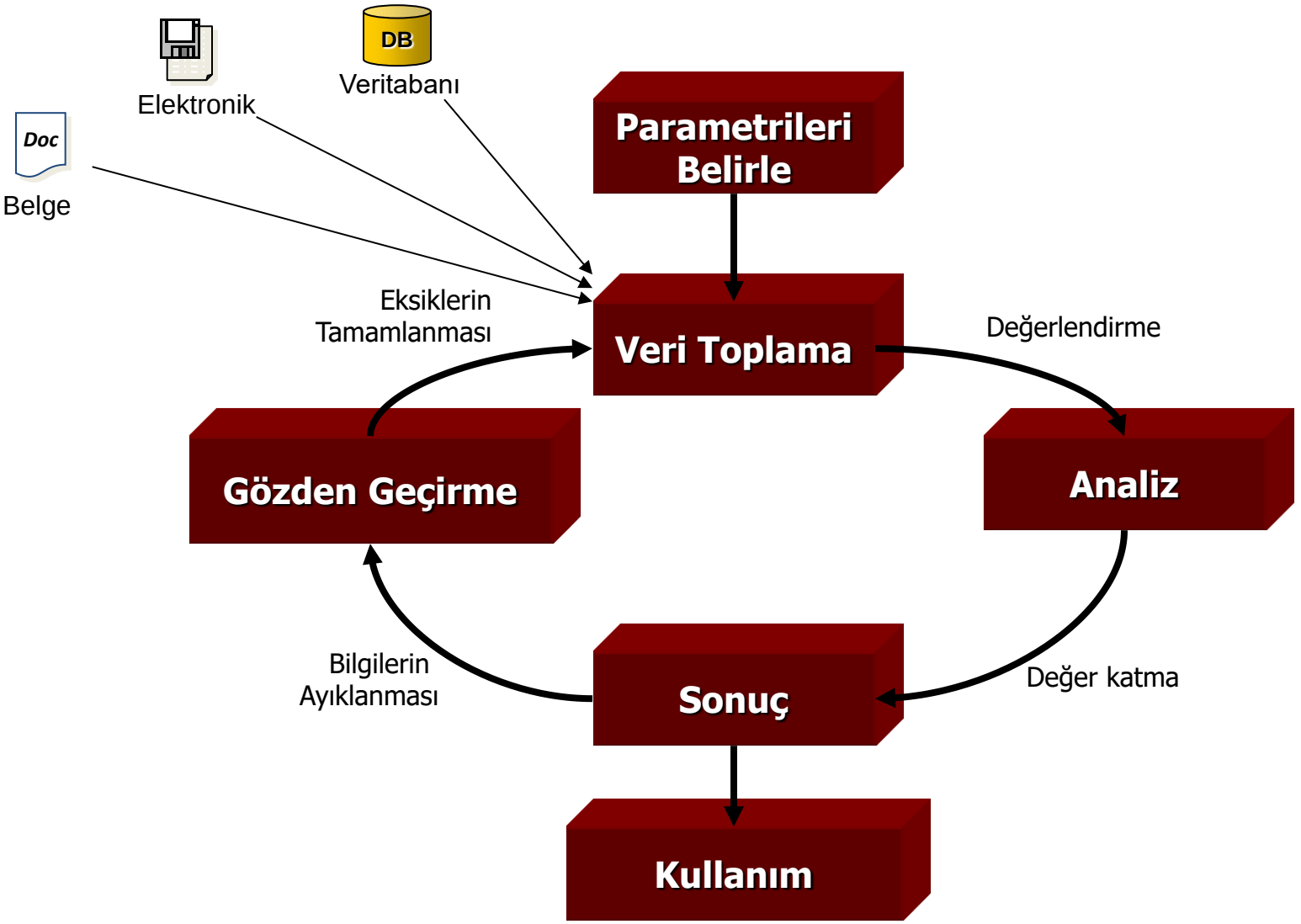
- Donanım
- Haberleşme
- İş Uygulamaları
- İş Akış Yazılımları
- Tedarik Zinciri
- İç/Dış Kaynak Kullanımı
- Ağ Toplumu

Değişiyor

- Sınırlar kalkıyor
- Ürün ve Hizmet çeşitleniyor
- Karmaşık Süreçler
- Dış Dünya'ya açık sistemler

➢ Küresel işbirliği

Çevrim


Elektronik
DB
Veritabanı
Doc
Belge
Parametrileri Belirle
Eksiklerin Tamamlanması
Veri Toplama
Değerlendirme
Gözden Geçirme
Analiz
Bilgilerin Ayıklanması
Sonuç
Değer katma
Kullanım

Scale of measurement

1. Organizing the data

- Organize all forms/questionnaires in one place
- Check for completeness and accuracy
- Remove those that are incomplete or do not make sense; keep a record of your decisions
- Assign a unique identifier to each form/questionnaire

Enter your data

- By hand
- By computer
  - Excel (spreadsheet)
  - Microsoft Access (database mngt)
  - Quantitative analysis: SPSS (statistical software)

- Count (frequencie
- Percentage
- Mean
- Mode
- Median
- Range
- Standard deviatio
- Variance
- Ranking
- Cross tabulation

3. Interpreting the information

Numbers do not speak for themselves.

For example, what does it mean that 55 youth reported a change in behavior. Or, 25% of participants rated the program a 5 and 75% rated it a 4. What do these numbers mean?

Interpretation is the process of attaching meaning to the data.

4. Discuss limitations

Written reports:

- Be explicit about your limitations

Oral reports:

- Be prepared to discuss limitations
- Be honest about limitations
- Know the claims you cannot make
  - Do not claim causation without a true experimental design
  - Do not generalize to the population without random sample and quality administration (e.g., <60% response rate on a survey)

Quantitative and qualitative

- Quantitative data – expressed as numbers
- Qualitative data – difficult to measure sensibly as numbers, e.g. count number of words to measure dissatisfaction
- Quantitative analysis – numerical methods to ascertain size, magnitude, amount
- Qualitative analysis – expresses the nature of elements and is represented as themes, patterns, stories

- Be careful how you manipulate data and numbers!

Simple quantitative analysis

- Averages
- Percentages
- Graphical representations give overview of data
- Visualizing log data
- Web analytics

Simple qualitative analysis

- Recurring patterns or themes
  - Emergent from data, dependent on observation framework if used
- Categorizing data
  - Categorization scheme may be emergent or pre-specified
- Looking for critical incidents
  - Helps to focus in on key events

Theoretical frameworks for qualitative analysis

- Basing data analysis around theoretical frameworks provides further insight
- Three such frameworks are:
  - Grounded Theory
  - Distributed Cognition
  - Activity Theory

Grounded Theory

- Aims to derive theory from systematic analysis of data
- Based on categorization approach (called here ‘coding’)
- Three levels of ‘coding’
  - –Open: identify categories
  - –Axial: flesh out and link to subcategories
  - –Selective: form theoretical scheme
- Researchers are encouraged to draw on own theoretical backgrounds to inform analysis

Distributed Cognition

- The people, environment & artefacts are regarded as one cognitive system
- Used for analyzing collaborative work
- Focuses on information propagation & transformation

Activity Theory

- Explains human behavior in terms of our practical activity with the world
- Provides a framework that focuses analysis around the concept of an ‘activity’ and helps to identify tensions between the different elements of the system
- Two key models: one outlines what constitutes an ‘activity’; one models the mediating role of artifacts

Verilerde gizlenmiş kuralları nasıl keşfedeceksiniz?

Evaluation of IDA results

- Absolute & relative accuracy
- Sensitivity & specificity
- False positive & false negative
- Error rate
- Reliability of rules
- Etc.

Veri Analiz Teknikleri

Part 1

(1) Contrastive analysis
- (a) explanation
- (b) hierarchy of difficulty
- (c) problems

(2) Error analysis
- (a) explanation
- (b) error taxonomy
- (c) mistake vs. error
- (d) interlanguage
- (e) fossilization
- (f) CA vs. EA perspectives on the learner
- (g) problems

(3) Performance analysis
- (a) definition
- (b) morpheme studies
- (c) developmental sequences
- (d) learner strategies
- (e) acquisition of forms and functions
- (f) formulaic utterances
- (g) limitations of PA

Veri analizi

- analysis, interpretation and presentation

- Matematiksel model ve algoritma
- Using Attendance Data Strategies for Analysis, Interpretation and Improvement

Veri analiz yöntemleri

- Bayesian data analysis

Veri Analiz Teknikleri

- Bilgisayar Destekli Denetim Araç ve Teknikleri
  - Sürekli Denetim ve Gözetim
- Denetim, Kontrol
- Tutarlılık
- Suistimal Araştırma ve Önleme
- Raporlama
- Risk Yönetim Teknikleri
- İlişki Analizi
- Metin (Text) Tarama Teknikleri
- Kimlik Çözümleme Teknikleri

Bilgisayar destekli denetim araçları

- Veri Tabanları
  - Access, MS SQL Server, ...
- Excel
- Raporlama Araçları
  - Crystal Report, BO, Cognos,...
- Denetim Özgü Yazılımlar
  - ACL (Audit Command Language)
  - IDEA
  - Picalo
  - TopCAATs

Veri Erişimi

- Veri ve Veri Kaynakları;
  - Veri haritası oluştur
    - Veri kaynakları
    - Veri Tabloları
    - Tablo İçerikleri
    - Veri sözlüğü
  - Bilgi İşlem Birimi ile işbirliği
  - Veri ve Veri teknolojileri

Veriye Erişim

Veri Kaynakları

- Veri tabanları (Oracle, SQL, Access, Excel, Sybase, DB2, AS400 vb.)
- Veri tabanı kayıtlarından üretilmiş dosyalar (genelde metin formatında *.txt)
- Sistem raporları (Excel, print dosyaları, txt dosyalar)
- Dış kaynaklı veriler çok farklı formatta gelebilir

Veri Doğrulama

- Yalnız analiz için gerekli olan tüm veri mi?
- Sayısal alanlarda sadece sayısal karakterler mi var?
- Mükerrer kayıt var mı?
- Geçersiz veri var mı?
- Veri alanları ile veri tutarlı mı?
- …..

Types of Data Analysis

Spatial data analysis

Usually involves manipulations or calculation of coordinates or attribute variables with a various operators (tools), such as:

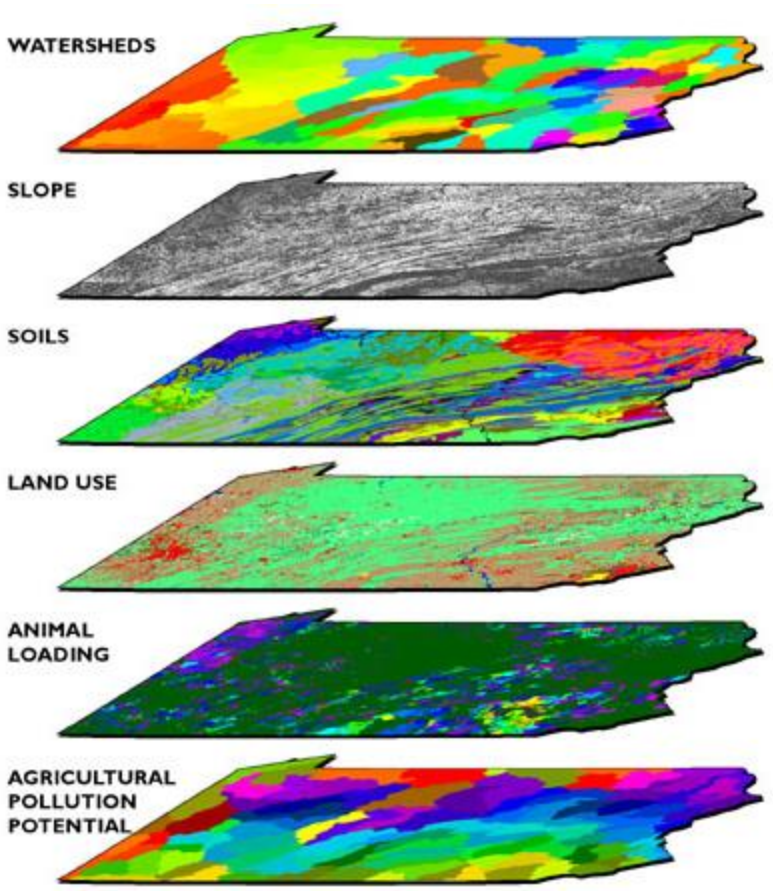
Measurement
Queries & Selection
Reclassification
Buffering
Overlay
Network Analysis

Overlay

Combination of different data layers
Both spatial and attribute data is combined

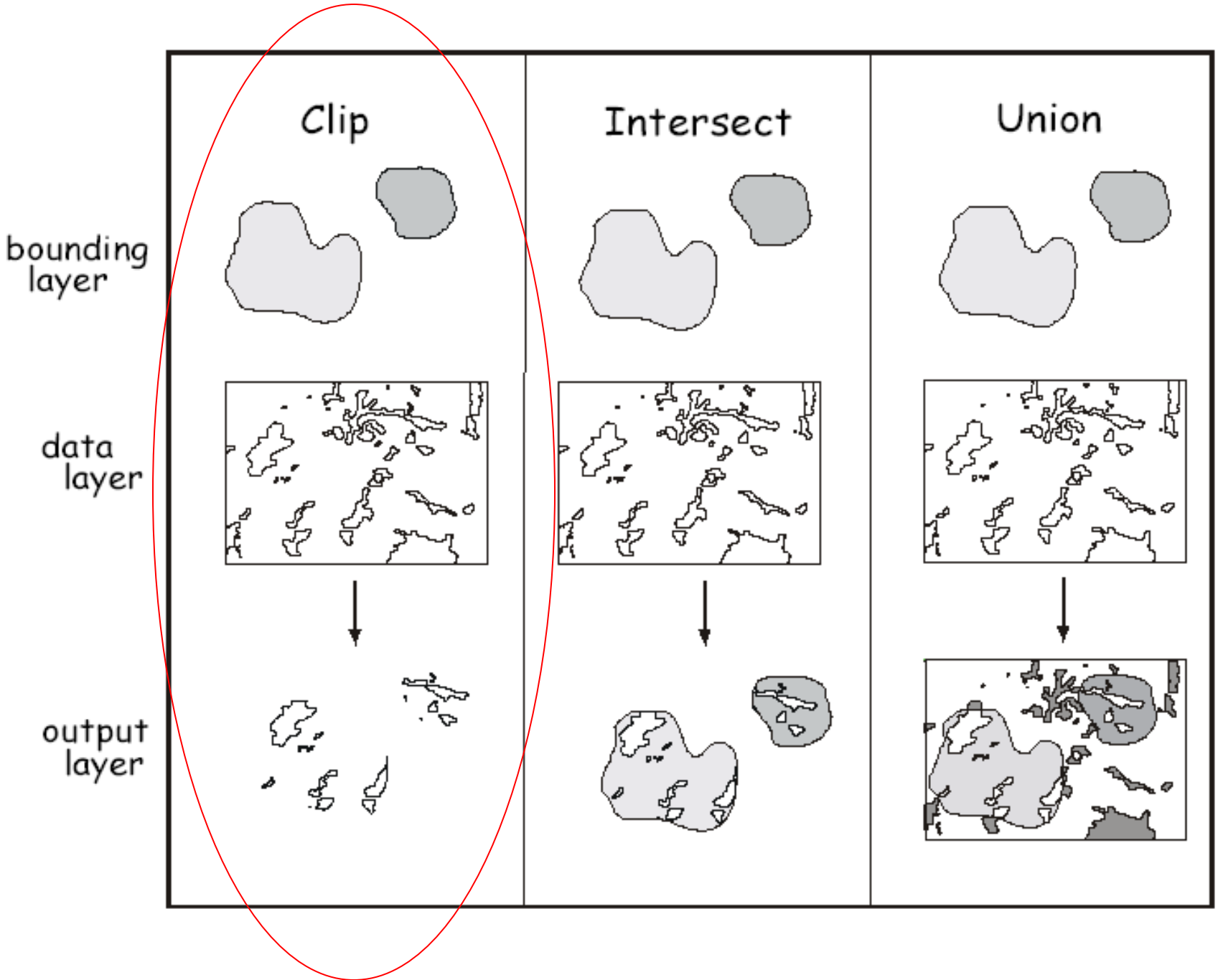
Requires that data layers use a common coordinate system

A new data layer is created



CLIP

- Cookie cutter approach
- Bounding polygon defines the clipped second layer
- Neither the bounding polygon attributes nor geographic (spatial data) are included in the output layer


Clip
Intersect
Union
bounding layer
data layer
output layer

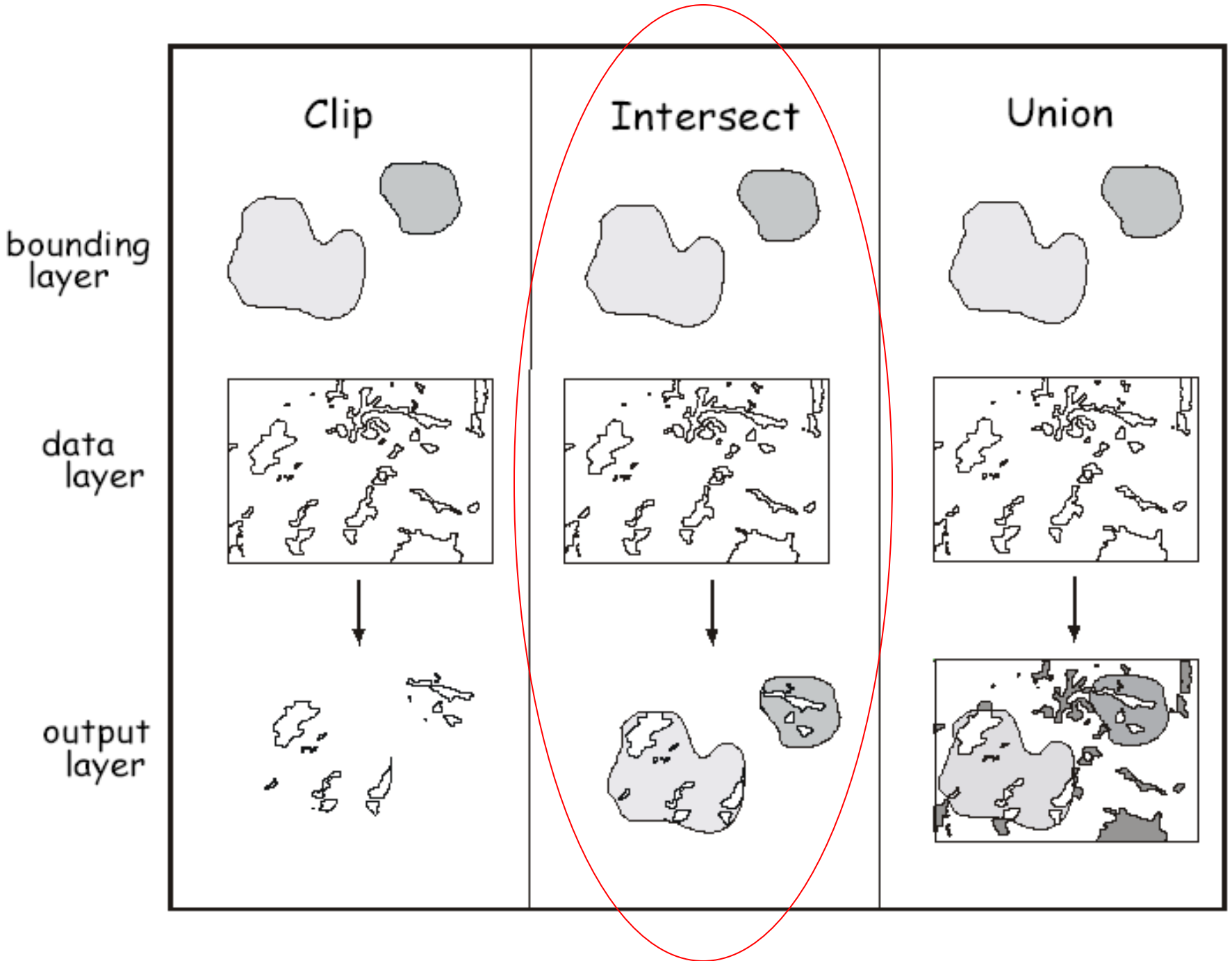
INTERSECTION

- Combines data from both layers but only for the bounding area

  (Bounding polygon also defines the output layer
  Data from both layers are combined
  Data outside the bounding layer (1st layer) is discarded)

- Order of intersection is important

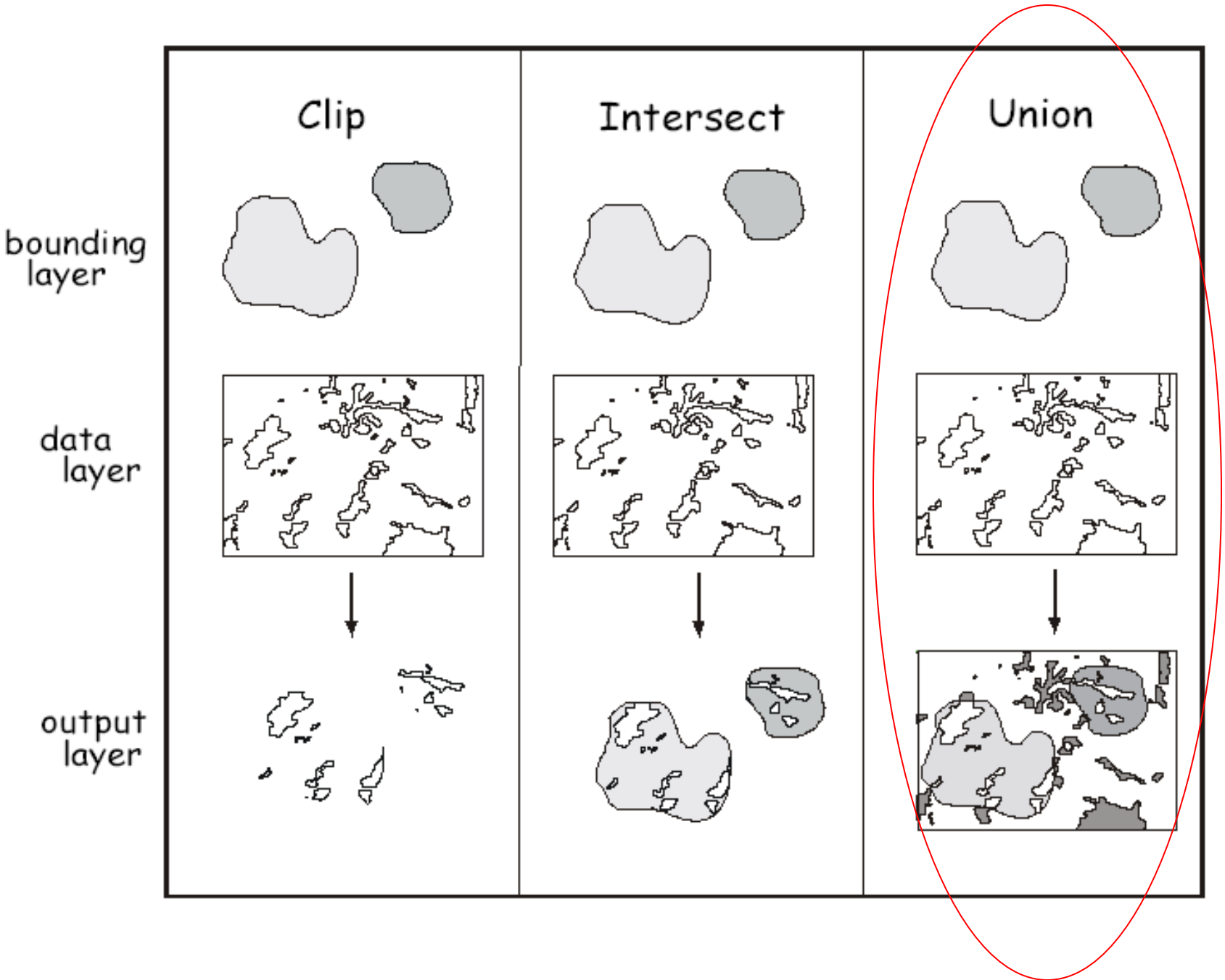
(A to B or B to A)


Clip
Intersect
Union
bounding layer
data layer
output layer

UNION

- Includes all data from both the bounding and data layers

- New polygons are formed by the combinations of the coordinate data from each layer


Clip
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output layer

Methods to reduce/remove slivers:

- Redefine the common boundaries with highest coordinate accuracy and replace them in all layers before overlay
- Manually identify and remove
- Use snap distance during overlay

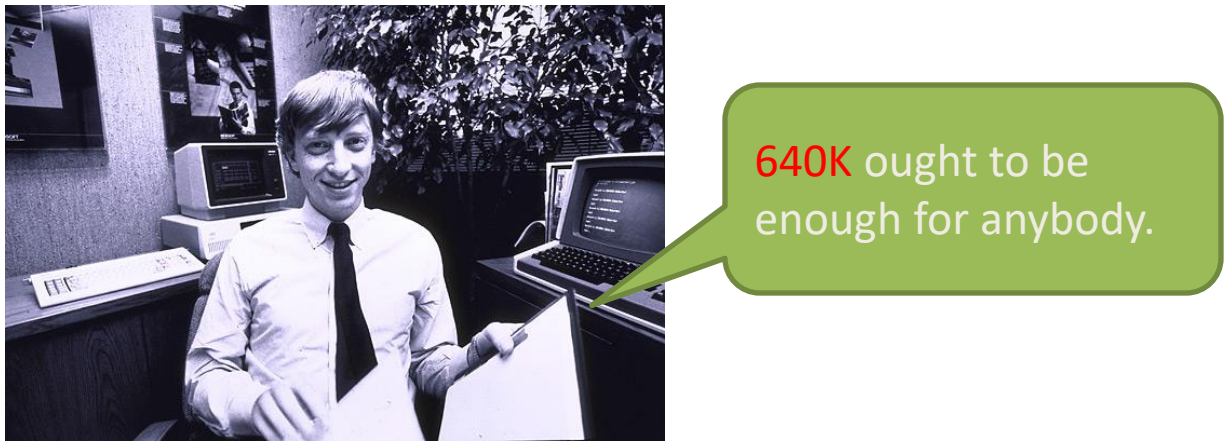
Big Data
&
Data Analysis

Big Data EveryWhere!

- Lots of data is being collected and warehoused
  - Web data, e-commerce
  - purchases at department/ grocery stores
  - Bank/Credit Card transactions
  - Social Network

How much data?

- Google processes 20 PB a day (2008)
- Wayback Machine has 3 PB + 100 TB/month (3/2009)
- Facebook has 2.5 PB of user data + 15 TB/day (4/2009)
- eBay has 6.5 PB of user data + 50 TB/day (5/2009)
- CERN's Large Hydron Collider (LHC) generates 15 PB a year



The Earthscope

- The Earthscope is the world's largest science project. Designed to track North America's geological evolution, this observatory records data over 3.8 million square miles, amassing 67 terabytes of data. It analyzes seismic slips in the San Andreas fault, sure, but also the plume of magma underneath Yellowstone and much, much more. (http://www.msnbc.msn.com/id/44363598/ns/technology_and_science-future_of_technology/#.TmetOdQ--ul)

Type of Data

- Relational Data (Tables/Transaction/Legacy Data)
- Text Data (Web)
- Semi-structured Data (XML)
- Graph Data
  - Social Network, Semantic Web (RDF), …
- Streaming Data
  - You can only scan the data once

What to do with these data?

- Aggregation and Statistics
  - Data warehouse and OLAP
- Indexing, Searching, and Querying
  - Keyword based search
  - Pattern matching (XML/RDF)
- Knowledge discovery
  - Data Mining
  - Statistical Modeling

Measures of Dispersion (Variance and Standard Deviation)

Variance:

$$var(X) = E[(X-\mu)^2] = \begin{cases} \sum_x (x-\mu)^2 \, f(x) & \text{if } X \text{ is discrete} \\ \int_{-\infty}^{\infty} (x-\mu)^2 \, f(x) \, dx & \text{if } X \text{ is continuous} \end{cases}$$

Standard Deviation:

$$\begin{aligned} \sigma^2 = var(X) &= E[(X-\mu)^2] = E[X^2 - 2\mu X + \mu^2] \\ &= E[X^2] - 2\mu E[X] + \mu^2 = E[X^2] - 2\mu^2 + \mu^2 \\ &= E[X^2] - (E[X])^2 \end{aligned}$$

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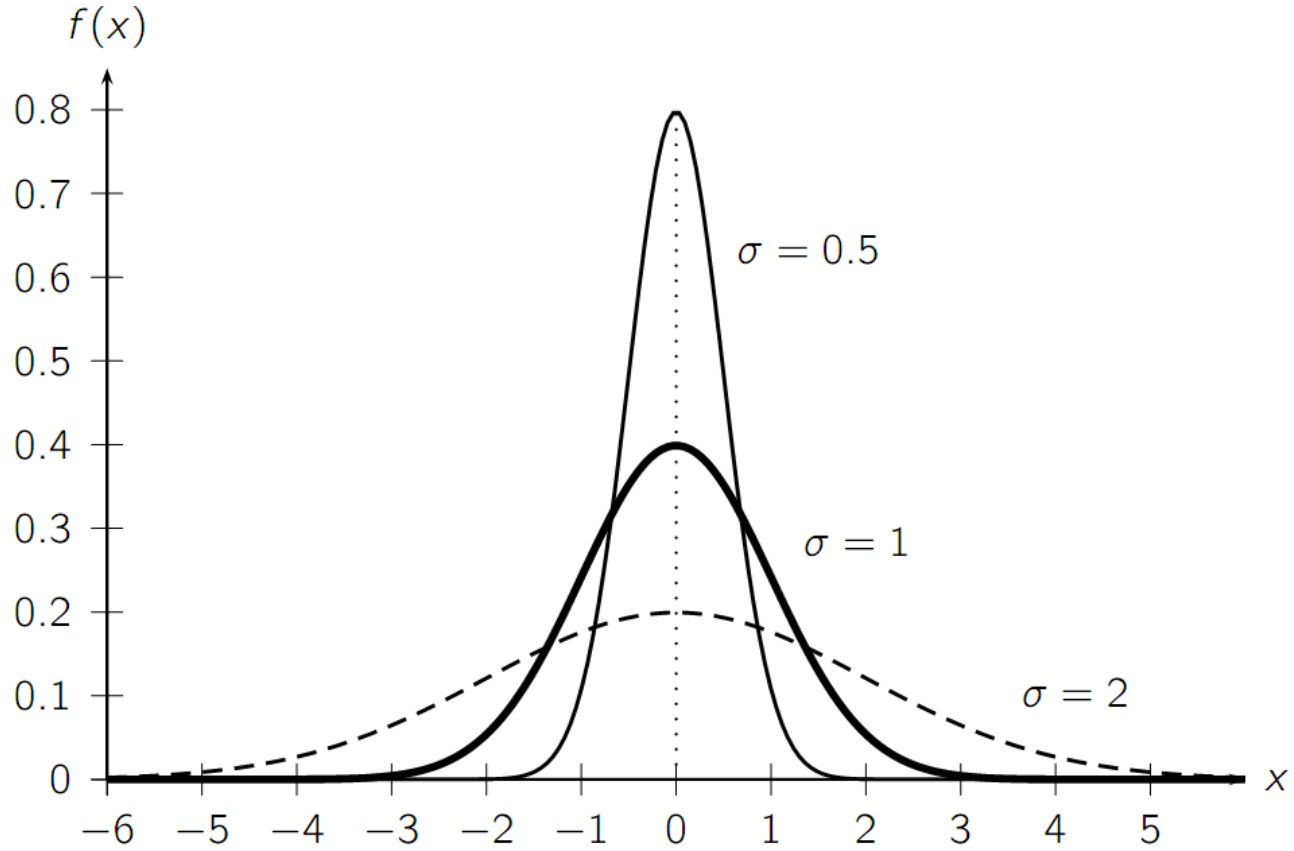
Sample Variance & Standard Deviation:

$$\hat{\sigma}^2 = \sum_x (x-\hat{\mu})^2 \hat{f}(x) = \sum_x (x-\hat{\mu})^2 \left(\frac{\sum_{i=1}^n I(S_i = x)}{n} \right) = \frac{\sum_{i=1}^n (S_i - \hat{\mu})^2}{n}$$

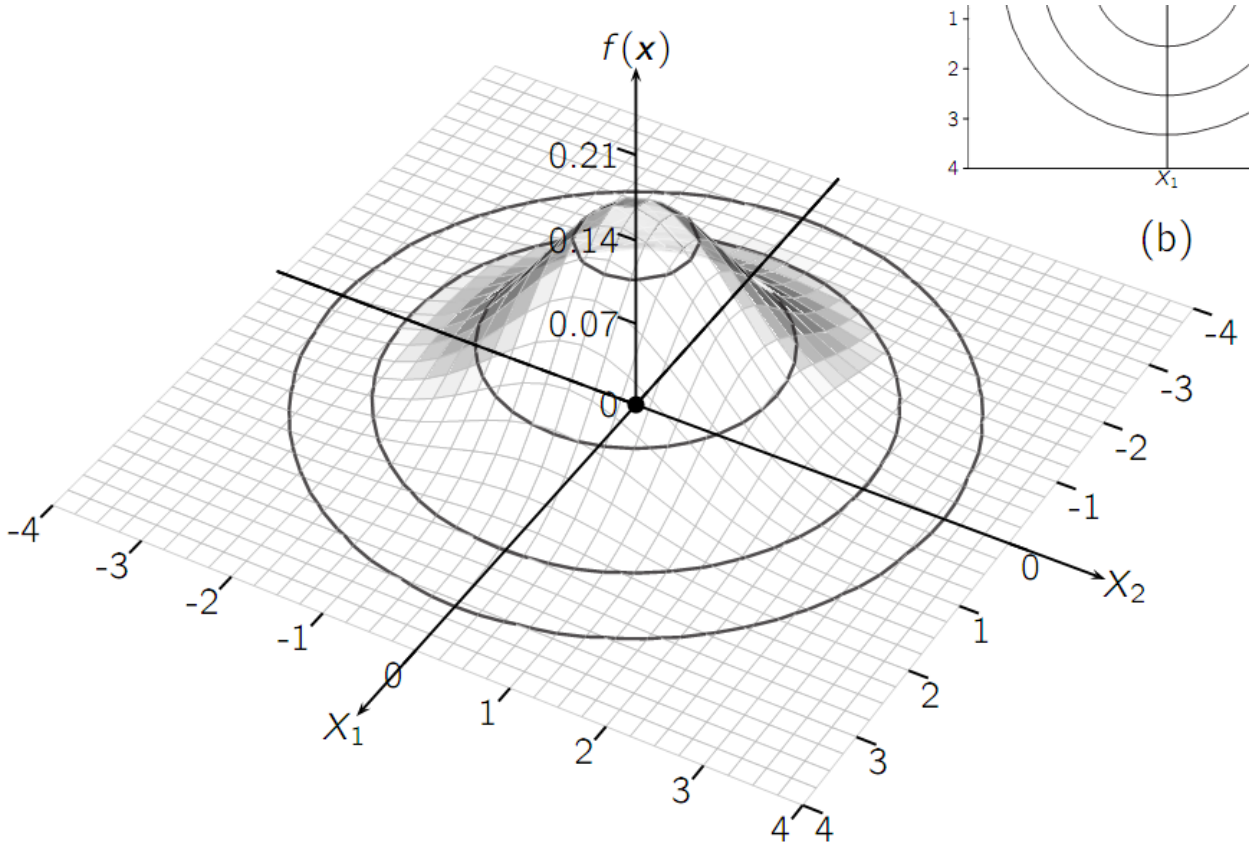
Univariate Normal Distribution

$$f(x|\mu,\sigma^2) = \frac{1}{\sqrt{2\pi\sigma^2}} \exp\left\{-\frac{(x-\mu)^2}{2\sigma^2}\right\}$$



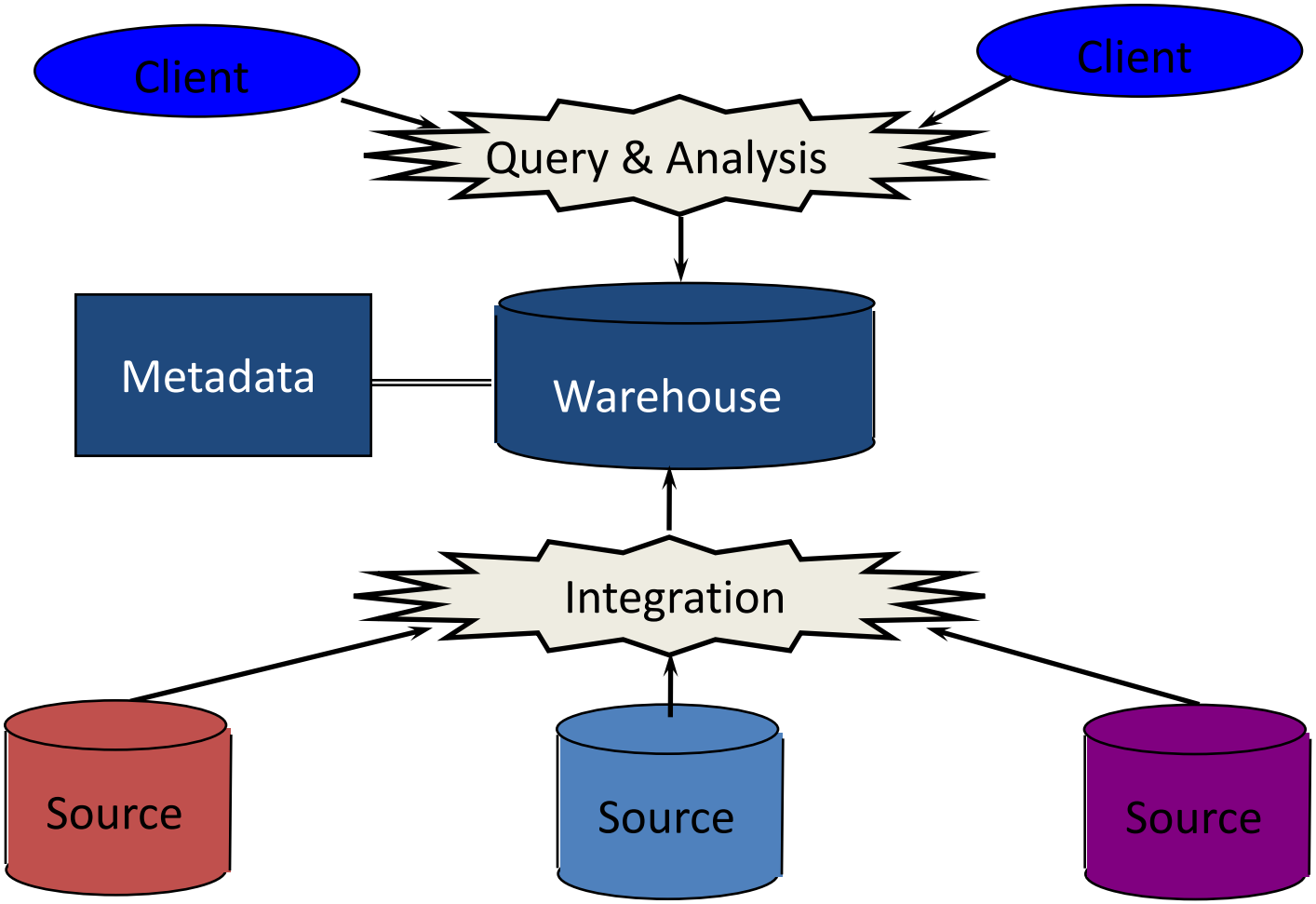
Multivariate Normal Distribution

$$f(\boldsymbol{x}|\boldsymbol{\mu}, \boldsymbol{\Sigma}) = \frac{1}{(\sqrt{2\pi})^d \sqrt{|\boldsymbol{\Sigma}|}} \exp\left\{ -\frac{(\boldsymbol{x}-\boldsymbol{\mu})^T \boldsymbol{\Sigma}^{-1} (\boldsymbol{x}-\boldsymbol{\mu})}{2} \right\}$$



Data Mining

Warehouse Architecture



What is Data Mining?

- Discovery of useful, possibly unexpected, patterns in data
- Non-trivial extraction of implicit, previously unknown and potentially useful information from data
- Exploration & analysis, by automatic or semi-automatic means, of large quantities of data in order to discover meaningful patterns
- Text mining, Graph Mining

Data Mining Tasks

- Classification [Predictive]
- Clustering [Descriptive]
- Association Rule Discovery [Descriptive]
- Sequential Pattern Discovery [Descriptive]
- Regression [Predictive]
- Deviation Detection [Predictive]
- Collaborative Filter [Predictive]

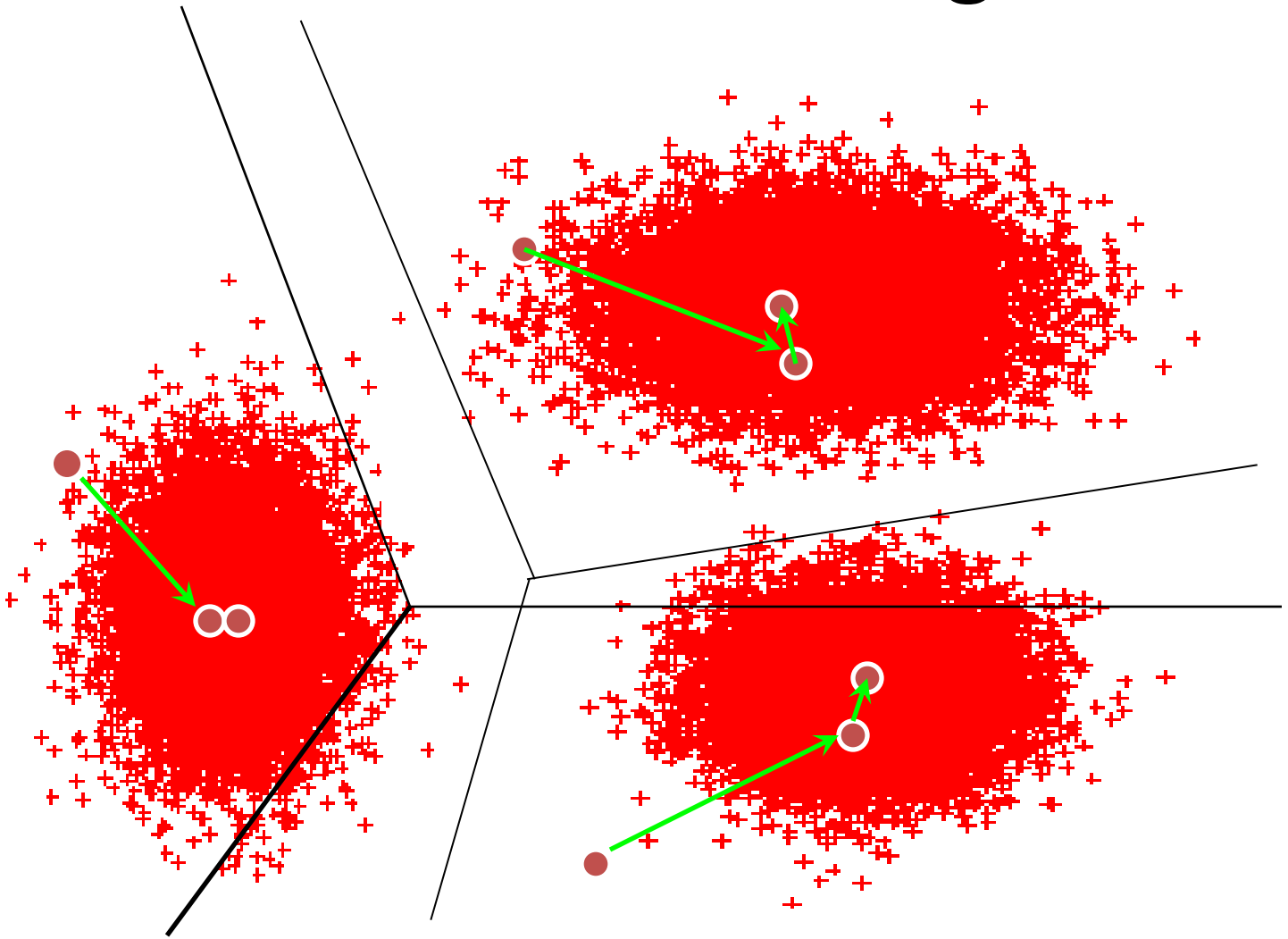
Classification: Definition

- Given a collection of records (*training set*)
  - Each record contains a set of *attributes*, one of the attributes is the *class*.
- Find a *model* for class attribute as a function of the values of other attributes.
- Goal: previously unseen records should be assigned a class as accurately as possible.
  - A *test set* is used to determine the accuracy of the model. Usually, the given data set is divided into training and test sets, with training set used to build the model and test set used to validate it.

Classification

- Star, Cube, 3-D Cube,
- Terms; Fact table, Dimension tables, Measures
- Relational On-Line Analytical Processing
- Multi-Dimensional On-Line Analytical Processing
- Aggregates
- Decision Trees: Decision Trees, Clustering
- Association Rule Mining
- Collaborative Filtering

K-Means Clustering



Data Streams

- What are Data Streams?
  - Continuous streams
  - Huge, Fast, and Changing
- Why Data Streams?
  - The arriving speed of streams and the huge amount of data are beyond our capability to store them.
  - “Real-time” processing
- Window Models
  - Landscape window (Entire Data Stream)
  - Sliding Window
  - Damped Window
- Mining Data Stream

Data presentation
&
interpretation

Görsel analiz araçları – İki boyutlu gösterim

GRAFİK,

- Renk: Koyuluk/açıklık; Renk kümeleri (soğuk; sıcak)
- Çizgi: Nitelik (sürekli; kesintili vb.),Kalınlık, Alan, Biçim (ok; üçgen; kare vb.)
- Resim: Fotoğraf, Tablo (yağlıboya,karakalem, minyatür vb.), karikatür
- Kroki
- Plan
- Rölöve – bir yapının bütün boyutlarını ölçerek plan, kesit ve görünüşünü yeniden çıkarma.
- Harita

Summarizing data

- Frequency distribution, Set of categories with numerical counts
- Tables
  - Simplest way to summarize data
  - Data are presented as absolute numbers or percentages
- Charts and graphs
  - Visual representation of data
  - Data are presented as absolute numbers or percentages

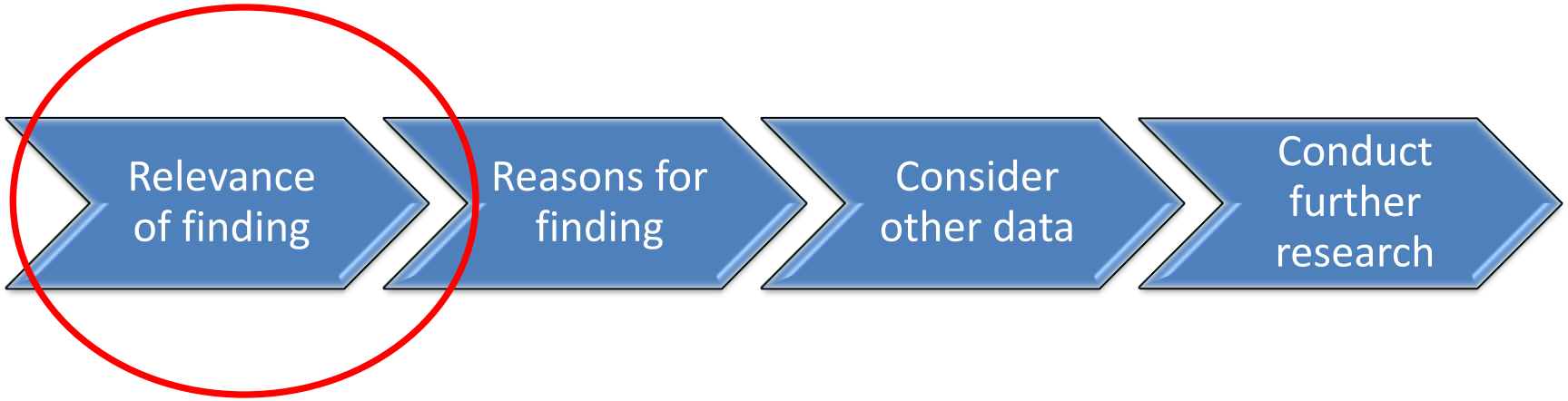
Interpreting data

Interpreting data

- Adding meaning to information by making connections and comparisons and exploring causes and consequences

Interpretation – relevance of finding

- Adding meaning to information by making connections and comparisons and exploring causes and consequences

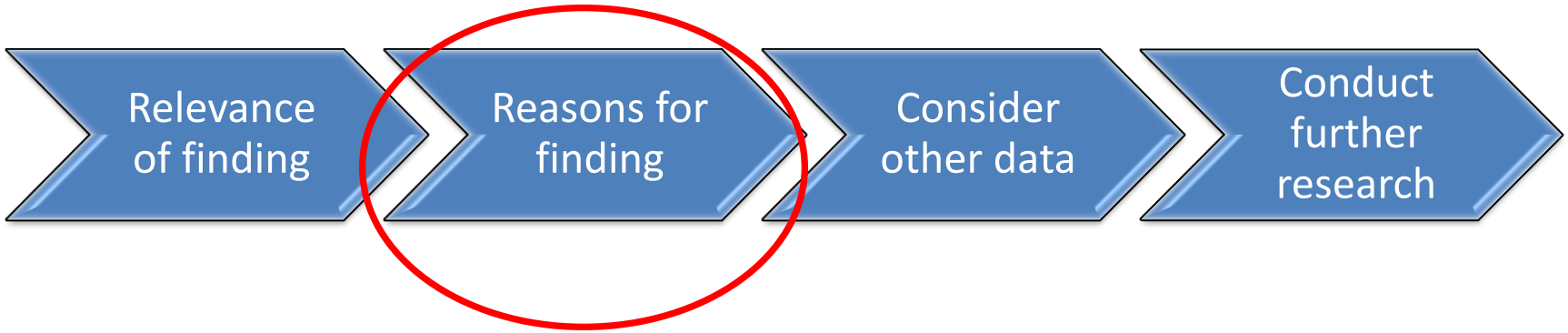


Interpretation – relevance of finding

- Does the indicator meet the target?
- How far from the target is it?
- How does it compare (to other time periods, other facilities)?
- Are there any extreme highs and lows in the data?

Interpretation – possible causes?

- Supplement with expert opinion
  - Others with knowledge of the program or target population

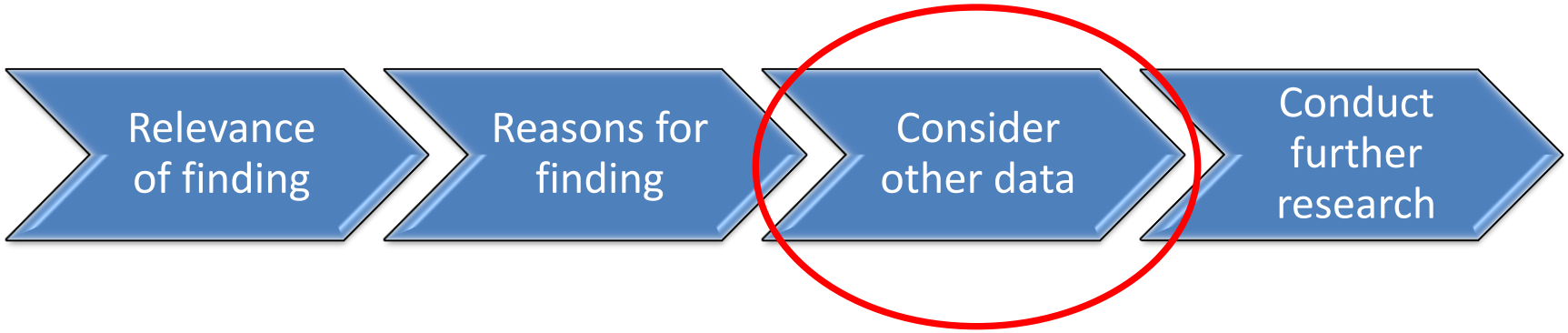


Interpretation – consider other data

Use routine service data to clarify questions

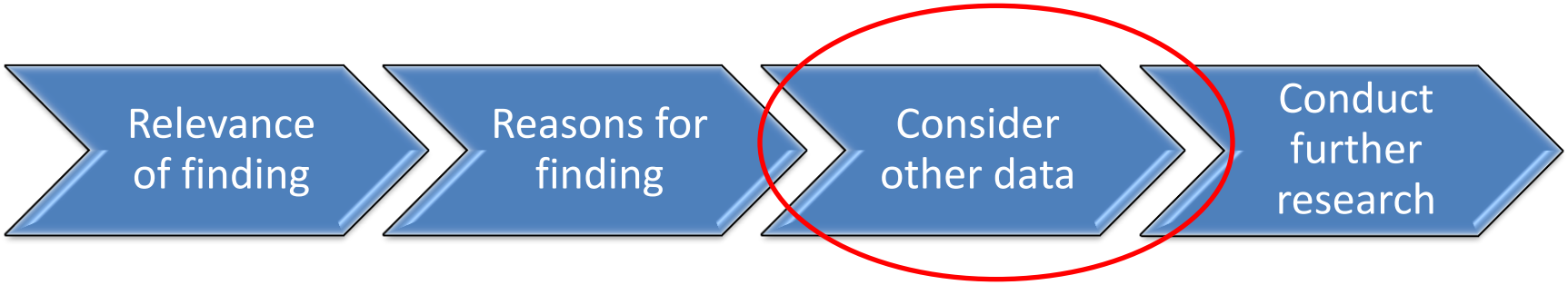
- Calculate nurse-to-client ratio, review commodities data against client load, etc.

Use other data sources



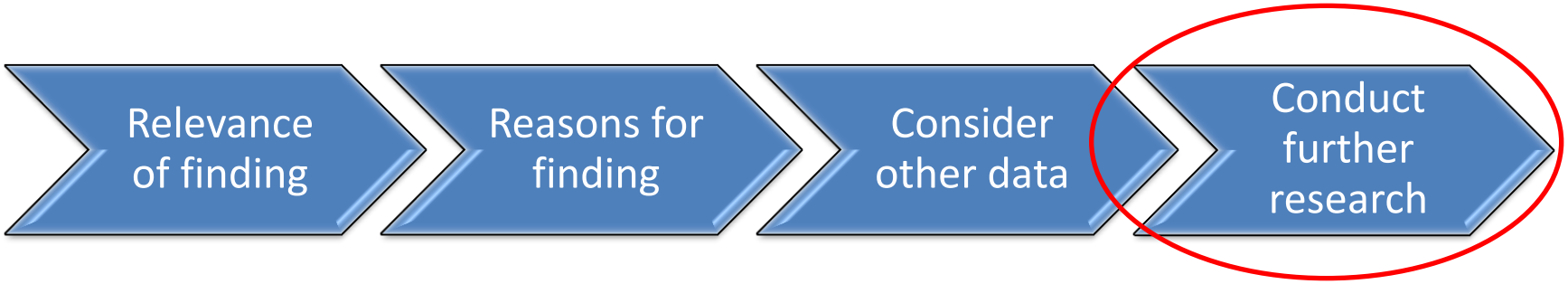
Interpretation – other data sources

- Situation analyses
- Demographic and health surveys
- Performance improvement data



Interpretation – conduct further research

- Data gap ⇒ conduct further research
- Methodology depends on questions being asked and resources available



Key messages

- Use the right graph for the right data
  - Tables – can display a large amount of data
  - Graphs/charts – visual, easier to detect patterns
  - Label the components of your graphic
- Interpreting data *a*dds meaning by making connections and comparisons to program
- Service data are good at tracking progress & identifying concerns – do not show causality

Statistical data analysis

Why we need statistical data analysis?

Investigations in diverse fields like agriculture, medicine, physics, biology, chemistry etc. require collection of “observations”. Observations are almost always subject to random error. Hence statistical methods have to be employed to collect as well as to analyze the data.

Statistical data analysis

Studying a problem through the use of statistical data analysis usually involves four basic steps:

1. Defining the problem.
2. Collecting the data.
3. Analyzing the data.
4. Conclusions and recommendations.

Defining the problem

An exact definition of the problem is imperative in order to obtain accurate data about it. It is extremely difficult to gather data without a clear definition of the problem.

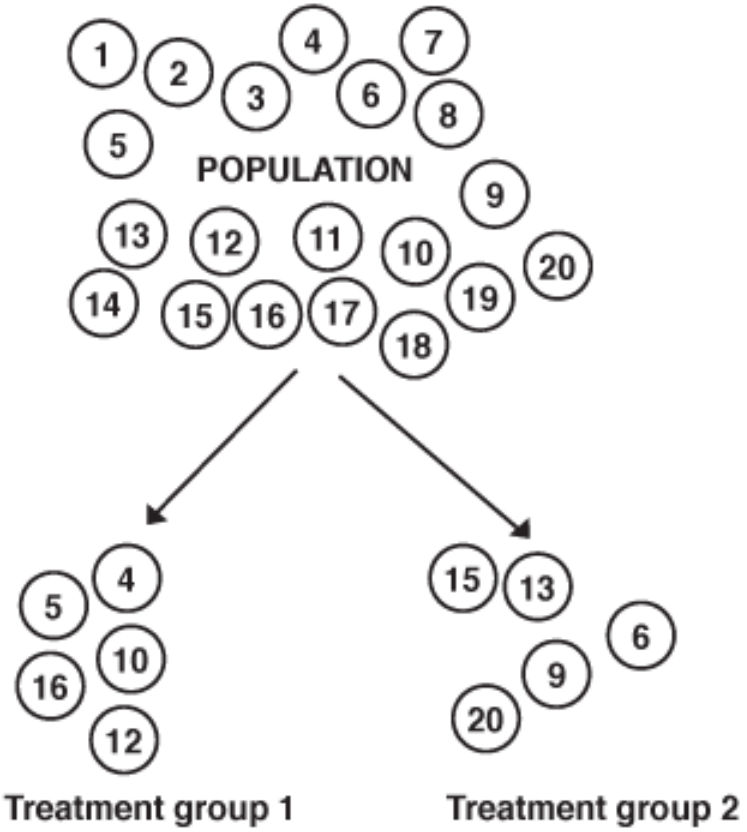
Collecting the data

The three basic principles of experimental design are:

1. Randomization.
2. Replication.
3. Blocking.

Randomization

Randomization is the cornerstone underlying the use of statistical methods in experimental design. By randomization we mean that both the allocation of the experimental material and the order in which individual runs or trials of the experiment are to be performed are randomly determined.

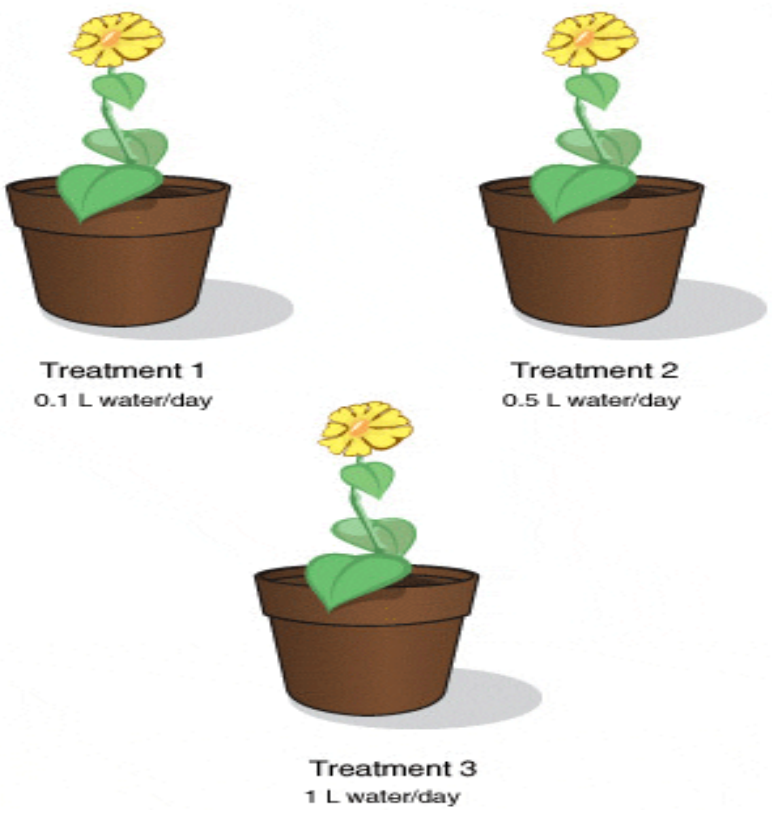


Replication

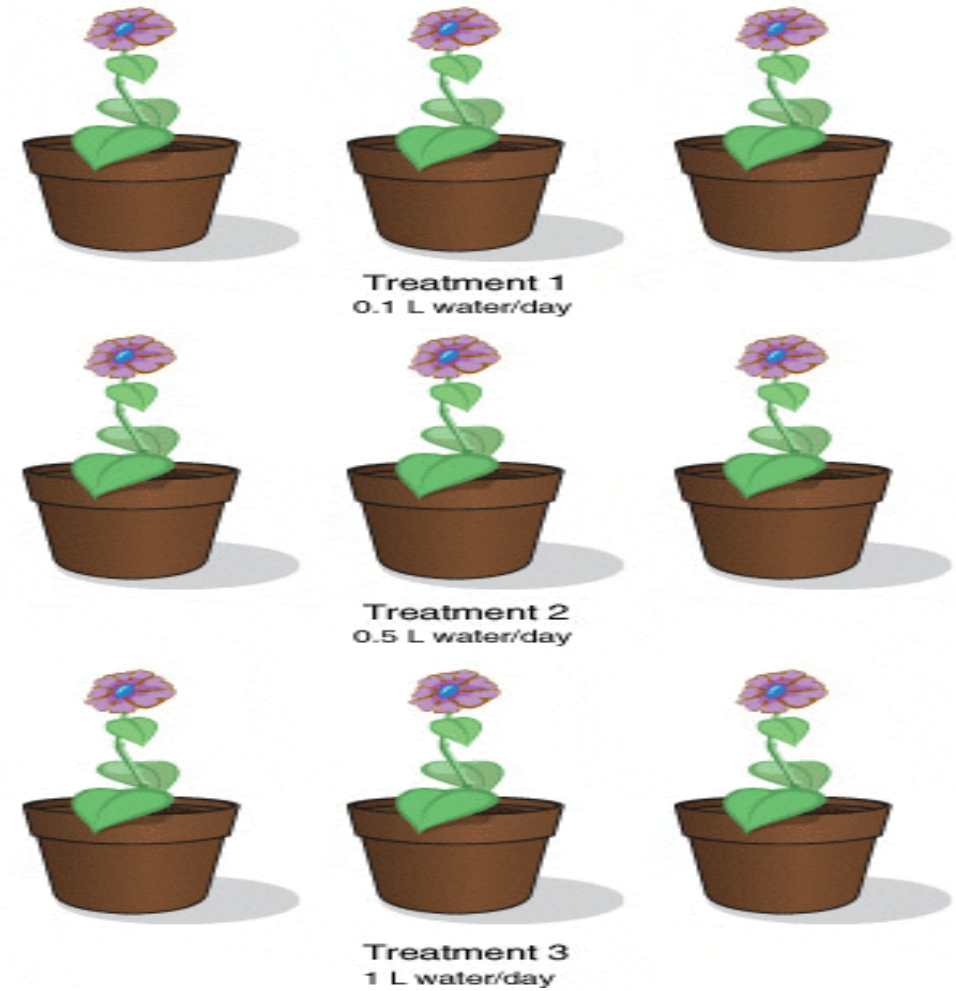
By replication we mean a repetition of the basic experiment. Replication has two important properties:

1. It allows the experimenter to obtain an estimate of the experimental error.
2. If the sample mean is used to estimate the effect of a factor in the experiment, then replication permits the experimenter to obtain a more precise estimate of this effect.

Without replication



With replication



Choice of sample size

Why would we want to plan?

1. The larger the sample sizes are, the easier it is to detect or find differences in the means.
2. The larger the sample size is, the higher the "cost" and the more likely that practically unimportant differences are to be found statistically significant.

Basic Statistics Terms

In order to determine the needed sample size we first must define some basic statistics terms.

Null hypothesis Ho is a hypothesis that is presumed true until statistical evidence in the form of a hypothesis test indicates otherwise.

In formulating a particular null hypothesis, we are always also formulating an **alternative hypothesis Ha**, which we will accept if the observed data values are sufficiently improbable under the null hypothesis .

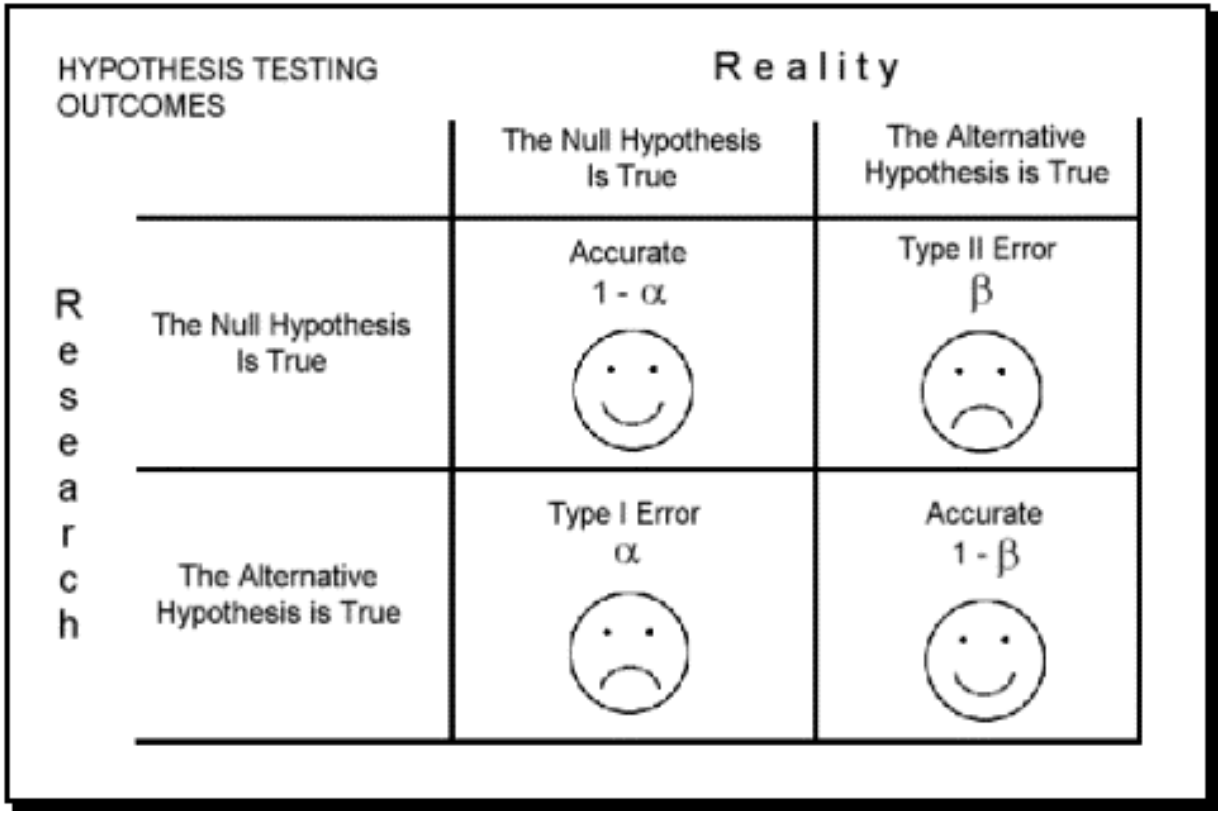
Definition of Type I and Type II errors

Sometimes our decisions will be correct and sometimes not. There are two possible errors, which we will call Type I and Type II errors, respectively.

A *Type I error* is the error of rejecting the null hypothesis when it is true. The probability of committing a Type I error is usually denoted by α.

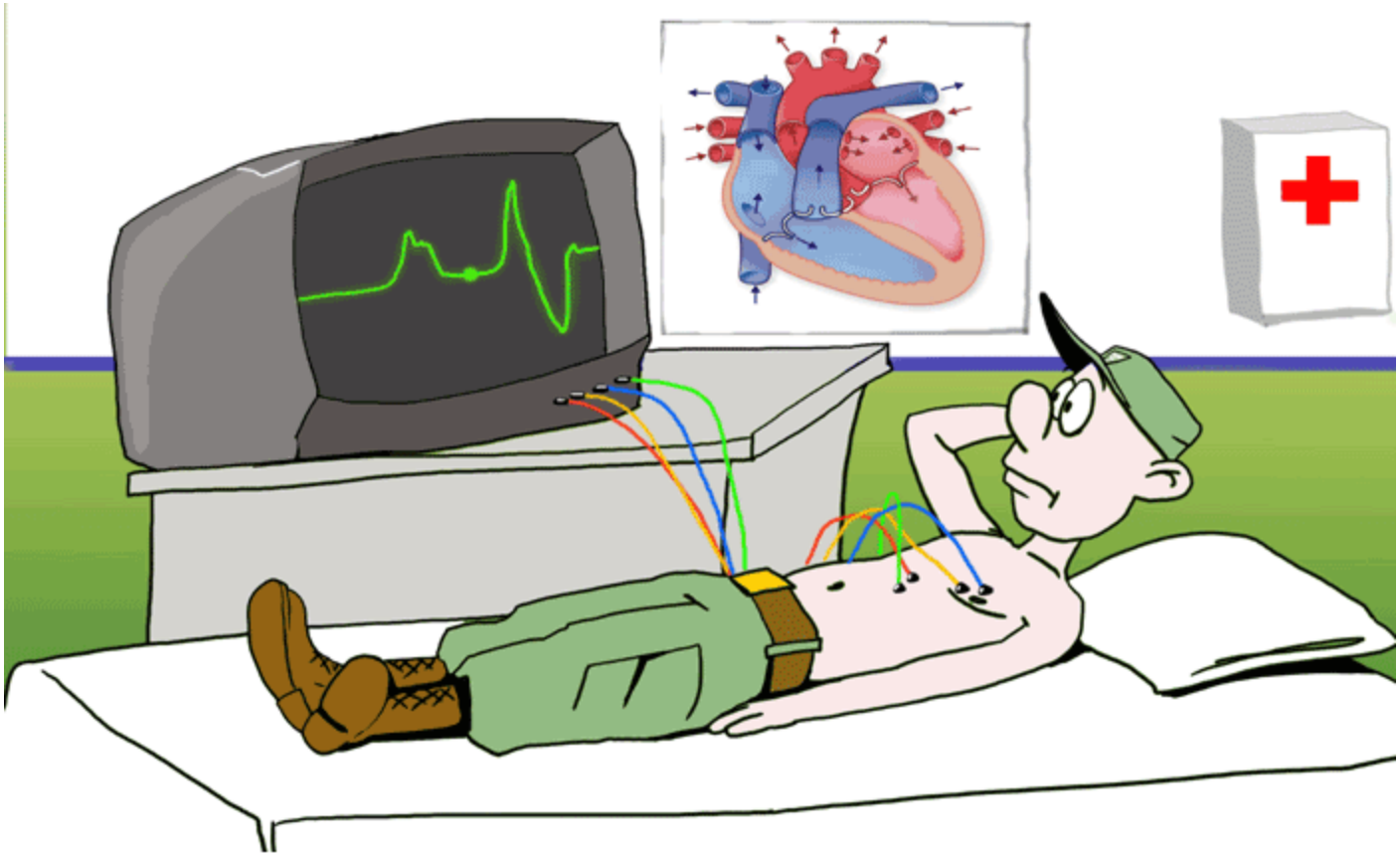
A *Type II error* is the error of accepting the null hypothesis when it is false. The probability of making a Type II error is usually denoted by β.

Type I and Type II errors



Technical analysis

- Daha önce "teknik analizin her analiz türü arasında en basit olduğunu duyduğunuzu" söylemiş olsanız da, sizinle aynı fikirdeyim.
- Teknik analiz, kaç çeşit olduğunu hayal bile edemeyeceğiniz pek çok alt türü içeriyor olmasıdır.
- Teknik analizin her bir alt türü, örneğin temel analizden çok, anlama ve uygulama için daha az zaman gerektirir. Ancak her alt türü diğerlerinden çok farklıdır ve burada karşılaşılan en önemli sorun, kişisel olarak sizin için kesinlikle uygun olan türü bulmaktır. Ve bu, örneğin temel analiz çalışması kadar zaman isteyebilir.

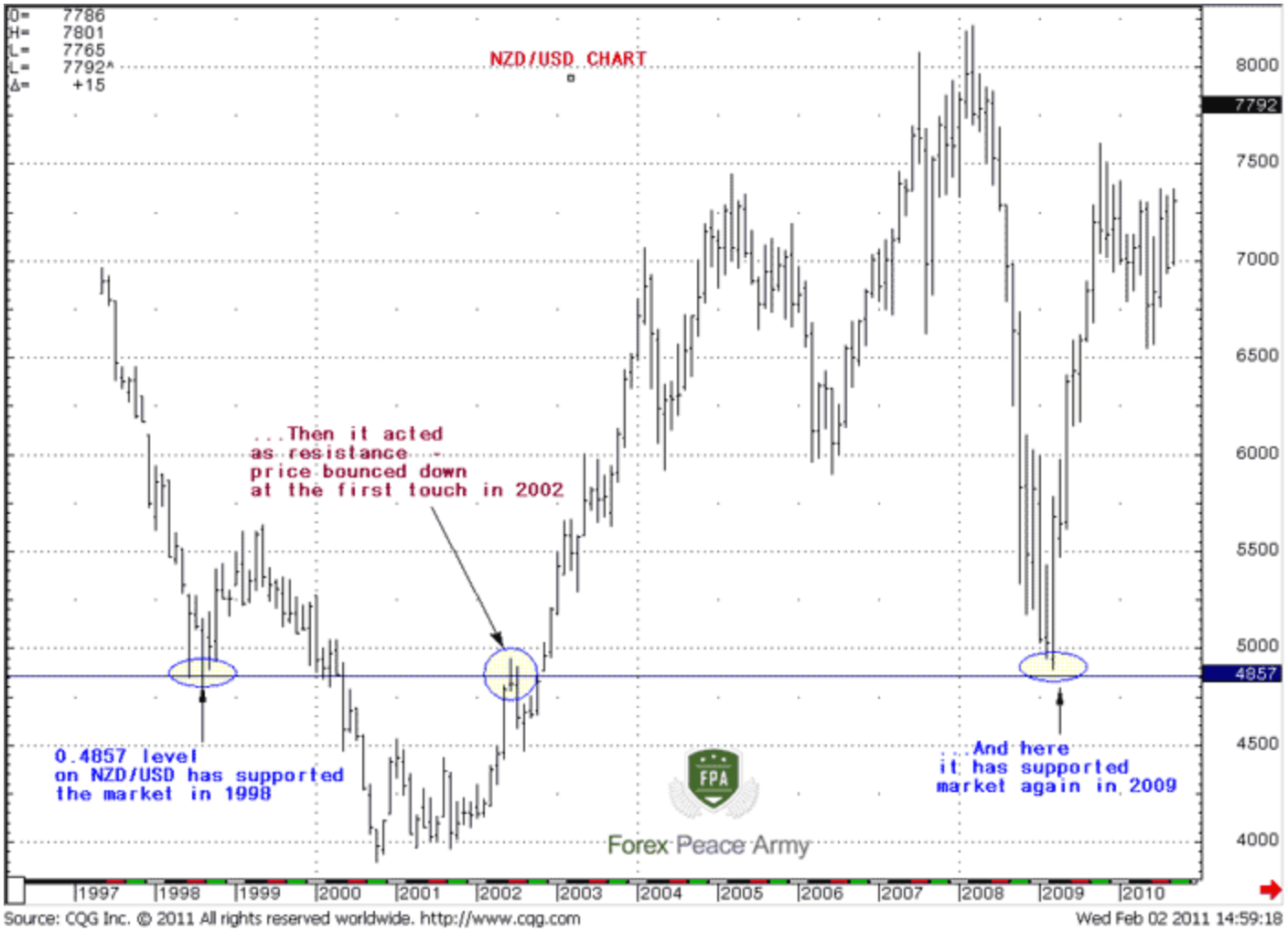


Technical analysis mostly deals with charts...

Teknik Analiz

- Tarihsel fiyat hareketlerini analiz etmek ve mevcut ticaret ortamını göz önüne almak potansiyel fiyat hareketini belirlemeye izin verir.
- Aklıma gelen eski bir ifade var - o tarihin tekrar tekrar etme eğiliminin var olmasıdır.
- Aslında bunların hepsi teknik analiz konusu ile ilgilidir. Fiyat, tepeden tırmanışa (direnç) veya olumsuzluğa (destek) kadar kıramadığı bazı alanları gösterdiğinde, tüccarlar mutlaka not edip ticaret stratejilerini bu bilgilere dayanarak ayarlarlar.
- Teknik analiz çalışmaları yalnızca belirli seviyeleri değil, bazı tarihi fiyat hareket modelleri ile teknik tüccarlar ve analistler, bu kalıpların gelecekte tekrarlanacağına ve fiyatın aynı şekilde davrandığına inanıyor. Yatırımcılar, bu fiyat modellerini tekrarlama konseptine dayanan ticaret fikirlerini yaratırlar.

NZD – New Zealand Dollar



Try your own IDA…

Thank you!