In my data there is knowledge or just garbage?

by Roberto Bello

(Translation with Google Translate from Italian)

The DATA when are BIG are difficult to use.

The BIG DATA should be used to discover new business opportunities.

BUT

There are too many information that you already know by heart: in the trash.
More information is incomplete: in the trash.
More information is absurd: in the trash.
More information is visible false: in the trash.
More information is off topic: in the trash.

More information is ...: in the trash.

The remaining DATA is still too BIG.
With a simple program written in any language it is possible to obtain a random sample that can be considered a NORMAL DATA compared to starting BIG DATA.

We could use the NORMAL DATA to get the tables crossing the variables that a priori we consider interesting.

But the variables are too many to cross and we are not sure that you have identified the right ones.

I get the suggestion to use a program of unsupervised neural networks to categorize my NORMAL DATA in separate groups with homogeneous characteristics within each group.

So I can discover the interesting characteristics of groups that never, ever would have imagined existed (customers unhappy with that purchase anyway).

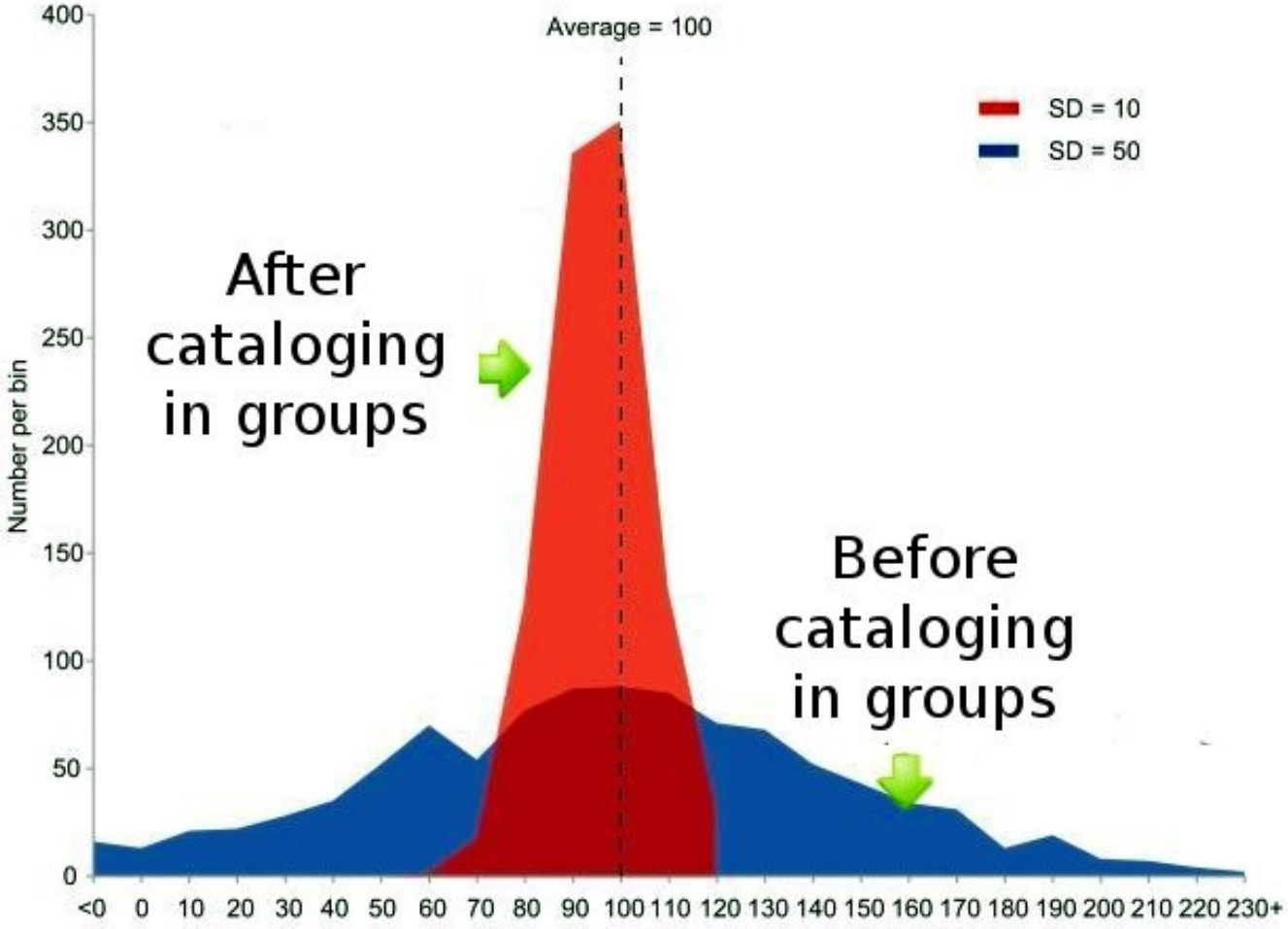
But neural networks are neural and stupid as ever; they do their job of cataloging even if the data were generated randomly or are simply rubbish.

We need to find a tool that can measure the quality of cataloging into groups by comparing the starting NORMAL DATA (input) with the arrival NORMAL DATA (output) divided into groups.

I went back to my studies in statistics.

I found that the comparison of the coefficients of variation of the starting NORMAL DATA with the coefficients of variation of the cataloged groups would be the solution.

Whether in NORMAL DATA input is contained knowledge, cataloging with unsupervised neural networks, allows to obtain groups with a dispersion of the values of the variables around their average significantly lower than the dispersion found in the variables of the NORMAL DATA input.



My solution is called pompously KINDEX (Knowledge Index).

KINDEX (Knowledge Index) is an index that measures how much knowledge is contained in the groups cataloged.
In the case KINDEX reaches the maximum value of 1, each group would be composed of records with constant values in all variables / columns and would make each group quite distinct from the other groups.
KINDEX is calculated using the weighted-average CV of the variables / columns groups comparing them to the CV of the variables / columns of the input file before the cataloging.

$$KIndex = 1 - \frac{\sum_{i=0}^{n} CV^{(i)} * num^{(i)} \div numtot}{CVpop}$$

Where CV is the standard deviation divided by the mean:

$$CV = \frac{\sigma}{\mu}$$

Here is the program written in Python to calculate KINDEX which gave the following results:

kIndex input 0.108018012706
KIndex output 0.776356339489

Il file degli animali contiene conoscenza.

```
# -*- coding: utf-8 -*-
# KIndex (Knowledge Index) by Roberto Bello
"""
Achieved cataloging into groups by a SOM neural network,
the question arises whether or not there is knowledge in
the groups, namely whether the groups are between them
distinct and have homogeneous characteristics within each
group.
The use of the coefficient of variation (CV) can be of
help.

KINDEX (Knowledge Index) is an index that measures how much
knowledge is contained in the groups obtained from the SOM
neural network: in the case KINDEX reaches the maximum
value of 1, each group would consist of records with
constant values in all the variables / columns, and each
group would be quite distinct from other groups.
KINDEX is calculated using the weighted-average CV of
variables / columns groups, comparing them to the CV of the
```

variables / columns of the input file before cataloging.

****
Ottenuta la catalogazione in gruppi da una rete neurale di tipo SOM, sorge il dubbio se nei gruppi esista o meno della conoscenza, ossia se i gruppi sono fra di loro distinti e con caratteristiche omogenee all'interno di ogni gruppo.
L'utilizzo del coefficiente di variazione (CV) può essere di aiuto.
KIndex (Knowledge Index) è un indice che misura quanta conoscenza sia contenuta nei gruppi catalogati: nel caso KIndex raggiunga il valore massimo di 1, ogni gruppo sarebbe composto da record con valori costanti in tutte le variabili / colonne e renderebbe ogni gruppo del tutto distinto dagli altri gruppi.
KIndex è calcolato utilizzando i CV medi-ponderati delle variabili / colonne dei
gruppi rapportandoli al CV delle variabili / colonne del file di input prima della
catalogazione.

"""

```
def mean(x):          # mean
  x = [float(i) for i in x]
  n = len(x)
  mean = sum(x) / n
  if mean == 0.0:
    mean = 0.0000000000001
  return mean

def sd(x):       # standard deviation
  x = [float(i) for i in x]
  n = len(x)
  mean = sum(x) / n
  if mean == 0.0:
    mean = 0.0000000000001
  sd = (sum((x-mean)**2 for x in x) / n) ** 0.5
  return sd

arr0 =
```

```
[['*Group*','ANIMAL','FUR','FEATHER','EGGS','MILK','FLYING'
,'AQUATIC','PREDATORY',
'TEETH','VERTEBRATE','POLMONES','POISONOUS','FLIPPERS','LEG
S','TAIL','DOMESTIC'],
['G_00_00','ANTELOPE',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','BUFFALO',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','CALF',1,0,0,1,0,0,0,1,1,1,0,0,4,1,1],
['G_00_00','CAT',1,0,0,1,0,0,1,1,1,1,0,0,4,1,1],
['G_00_00','DEER',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','ELEPHANT',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','FIELD_MOUSE',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','GIRAFFE',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','GOAT',1,0,0,1,0,0,0,1,1,1,0,0,4,1,1],
['G_00_00','HAMSTER',1,0,0,1,0,0,0,1,1,1,0,0,4,1,1],
['G_00_00','HARE',1,0,0,1,0,0,0,1,1,1,0,0,4,1,0],
['G_00_00','KANGAROO',1,0,0,1,0,0,0,1,1,1,0,0,2,1,0],
['G_00_00','PONY',1,0,0,1,0,0,0,1,1,1,0,0,4,1,1],
['G_00_00','REINDEER',1,0,0,1,0,0,0,1,1,1,0,0,4,1,1],
['G_00_00','SQUIRREL',1,0,0,1,0,0,0,1,1,1,0,0,2,1,0],
['G_00_00','VAMPIRE',1,0,0,1,1,0,0,1,1,1,0,0,2,1,0],
['G_00_01','CAVY',1,0,0,1,0,0,0,1,1,1,0,0,4,0,1],
['G_00_01','GORILLA',1,0,0,1,0,0,0,1,1,1,0,0,2,0,0],
['G_00_02','BEE',1,0,1,0,1,0,0,0,0,1,1,0,6,0,1],
['G_00_03','CRAB',0,0,1,0,0,1,1,0,0,0,0,0,4,0,0],
['G_00_03','FLY',1,0,1,0,1,0,0,0,0,1,0,0,6,0,0],
['G_00_03','LADYBIRD',0,0,1,0,1,0,1,0,0,1,0,0,6,0,0],
['G_00_03','LOBSTER',0,0,1,0,0,1,1,0,0,0,0,0,6,0,0],
['G_00_03','MIDGE',0,0,1,0,1,0,0,0,0,1,0,0,6,0,0],
['G_00_03','MOLLUSK',0,0,1,0,0,0,1,0,0,0,0,0,0,0,0],
['G_00_03','MOTH',1,0,1,0,1,0,0,0,0,1,0,0,6,0,0],
['G_00_03','POLYP',0,0,1,0,0,1,1,0,0,0,0,0,8,0,0],
['G_00_03','PRAWN',0,0,1,0,0,1,1,0,0,0,0,0,6,0,0],
['G_00_03','STARFISH',0,0,1,0,0,1,1,0,0,0,0,0,5,0,0],
['G_00_03','WASP',1,0,1,0,1,0,0,0,0,1,1,0,6,0,0],
['G_01_00','BEAR',1,0,0,1,0,0,1,1,1,1,0,0,4,0,0],
['G_01_00','BOAR',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','CHEETAH',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','LEOPARD',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','LION',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','LYNX',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','MINK',1,0,0,1,0,1,1,1,1,1,0,0,4,1,0],
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['G_01_00','MOLE',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','MONGOOSE',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','OPOSSUM',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','POLECAT',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','PUMA',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_00','WOLF',1,0,0,1,0,0,1,1,1,1,0,0,4,1,0],
['G_01_02','SCORPION',0,0,0,0,0,0,1,0,0,1,1,0,8,1,0],
['G_01_03','FLEA',0,0,1,0,0,0,0,0,0,1,0,0,6,0,0],
['G_01_03','SNAIL',0,0,1,0,0,0,0,0,0,1,0,0,0,0,0],
['G_01_03','TERMITE',0,0,1,0,0,0,0,0,0,1,0,0,6,0,0],
['G_01_03','WORM',0,0,1,0,0,0,0,0,0,1,0,0,0,0,0],
['G_02_00','DOLPHIN',0,0,0,1,0,1,1,1,1,1,0,1,0,1,0],
['G_02_00','SEAL',1,0,0,1,0,1,1,1,1,1,0,1,0,0,0],
['G_02_00','SEA_LION',1,0,0,1,0,1,1,1,1,1,0,1,2,1,0],
['G_02_01','DUCKBILL',1,0,1,1,0,1,1,0,1,1,0,0,4,1,0],
['G_02_02','TOAD',0,0,1,0,0,1,0,1,1,1,0,0,4,0,0],
['G_02_02','TORTOISE',0,0,1,0,0,0,0,0,1,1,0,0,4,1,0],
['G_03_00','CARP',0,0,1,0,0,1,0,1,1,0,0,1,0,1,1],
['G_03_00','CHUB',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','CODFISH',0,0,1,0,0,1,0,1,1,0,0,1,0,1,0],
['G_03_00','HERRING',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','PERCH',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','PIKE',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','PIRANHA',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','SEAHORSE',0,0,1,0,0,1,0,1,1,0,0,1,0,1,0],
['G_03_00','SEA_SNAKE',0,0,0,0,0,1,1,1,1,0,1,0,0,1,0],
['G_03_00','SHARK',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','SOLE',0,0,1,0,0,1,0,1,1,0,0,1,0,1,0],
['G_03_00','STURGEON',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_00','TUNA',0,0,1,0,0,1,1,1,1,0,0,1,0,1,0],
['G_03_01','FROG',0,0,1,0,0,1,1,1,1,1,0,0,4,0,0],
['G_03_01','TRITON',0,0,1,0,0,1,1,1,1,1,0,0,4,1,0],
['G_03_02','GULL',0,1,1,0,1,1,1,0,1,1,0,0,2,1,0],
['G_03_02','KIWI',0,1,1,0,0,0,1,0,1,1,0,0,2,1,0],
['G_03_02','PENGUIN',0,1,1,0,0,1,1,0,1,1,0,0,2,1,0],
['G_03_03','CHICKEN',0,1,1,0,1,0,0,0,1,1,0,0,2,1,1],
['G_03_03','CROW',0,1,1,0,1,0,1,0,1,1,0,0,2,1,0],
['G_03_03','DOVE',0,1,1,0,1,0,0,0,1,1,0,0,2,1,1],
['G_03_03','DUCK',0,1,1,0,1,1,0,0,1,1,0,0,2,1,0],
['G_03_03','FALCON',0,1,1,0,1,0,1,0,1,1,0,0,2,1,0],
['G_03_03','FLAMINGO',0,1,1,0,1,0,0,0,1,1,0,0,2,1,0],
```

```
['G_03_03','HAWK',0,1,1,0,1,0,1,0,1,1,0,0,2,1,0],
['G_03_03','OSTRICH',0,1,1,0,0,0,0,0,1,1,0,0,2,1,0],
['G_03_03','PHEASANT',0,1,1,0,1,0,0,0,1,1,0,0,2,1,0],
['G_03_03','SKYLARK',0,1,1,0,1,0,0,0,1,1,0,0,2,1,0],
['G_03_03','SPARROW',0,1,1,0,1,0,0,0,1,1,0,0,2,1,0],
['G_03_03','SWAN',0,1,1,0,1,1,0,0,1,1,0,0,2,1,0]]

# print "*********input*********"
# print arr0

# groups are not considered

num_col = len(arr0[0]) - 2
arr0 = arr0[1:]
n = 0
var = []
while n < len(arr0):
  lst1 = arr0[n]
  var.append(lst1[2:])
  n += 1

var         = zip(*var)

means_tot0  = 0.0
sd_tot0     = 0.0
n           = 0

while n < len(var):
  means_tot0 += mean(var[n])
  sd_tot0    += sd(var[n])
  n += 1

cv0 = sd_tot0 / means_tot0

# Groups are considered

recs = len(arr0)-1
groups = []
num_col = len(arr0[0]) - 2

n = 1
```

```
while n < len(arr0):
  lst1 = arr0[n]
  groups.append(lst1[0])
  n += 1
groups = list(set(groups))
groups.sort()

group_n     = 0
means_group = 0.0
sd_group    = 0.0

while group_n < len(groups):
  group = groups[group_n]
  var = []
  r = 0
  while r < len(arr0):
    lst1 = arr0[r]
    if lst1[0] == group:
      var.append(lst1[2:])
    r += 1

  var = zip(*var)
  n = 0
  while n < len(var):
    means_group += mean(var[n])*len(var[n])
    sd_group    += sd(var[n])*len(var[n])
    n += 1
  group_n += 1
means_tot = means_group/recs
sd_tot    = sd_group/recs
cv = sd_tot / means_tot
kindex = 1.0 - cv / cv0

print "kIndex (groups NOT considered)   " + str(1 - cv0)
print "KIndex (groups considered)       " + str(kindex)
```

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