

## Machine learning and GDV images: Current research and results

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### Abstract

We use machine learning to interpret the GDV coronas of human's fingers in order to verify three hypotheses: 1. The GDV images contain useful information about the object/patient, 2. The map of coronas of fingers according to Chinese medicine does make sense, and 3. The human bioelectric field can be influenced by some outside factors, such as special T-shirts. We performed three independent studies: (a) recording coronas of apple skin, in order to verify if we can obtain any useful information for distinguishing the sort, age and the sun/shadow part of the apple, (b) detecting the state of menstrual cycle for females, and (c) detecting of the influence of different T-shirts on human's bioelectric field.

### Introduction

As described in (Kononenko et al., 1999, in this Volume) machine learning technology (Mitchell, 1997; Dietterich and Shavlik, 1990) is well suited for the induction of diagnostic and prognostic rules and solving of small and specialized classification, diagnostic and prognostic problems. Data about correct classification is often available together with the description of objects. All that has to be done is to arrange the data, i.e. the records of the objects with known correct class, in the appropriate form and run the learning algorithm. This is of course an oversimplification, but in principle, the classification knowledge can be automatically derived from the description of cases solved in the past. The derived classifier can then be used either to assist the expert when classifying new objects in order to improve the classification speed, accuracy and/or reliability, or to train the students or beginners non-specialists to classify the objects in some special classification problem. We use machine learning in order to interpret the GDV images (Korotkov, 1998). Recently developed technology for recording human's bioelectric field by using the Gas Discharge Visualisation (GDV) technique provide a possibly useful information about the biophysical and psychical state of the object/patient that could in some cases improve the classification/diagnostic process. However, the problem is the interpretation of the GDV images. By using machine learning we could alleviate that problem by means of automatically generating classification rules from GDV images. For that purpose the Kirlian images need to be described with a set of parameters. Korotkov's team has developed a computer program that generates the corona of the whole human's body from coronas of all ten fingertips. The program is based on a map, known from traditional Chinese medicine and described in Mandel's book (1986). This map defines regions (sectors) of each finger's corona to be related with specific organ or organ system in the body. Korotkov (1998) and his team slightly modified this map. The GDV images are described with a set of 610 numeric attributes (see Kononenko et al., 1999, in this Volume).

We performed three independent studies: recording coronas of apple skin in order to verify if we can obtain any useful information for distinguishing the sort, age and the sun/shadow part of the apple

(described in Section 2), detecting the state of menstrual cycle for females (Section 3), and detecting of the influence of different T-shirts on human's bioelectric field (Section 4).

## Recording coronas of apples

The aim of the study was to determine, whether Kirlian camera can record any useful information by recording coronas of apples. We decided to record the coronas of peels that were cut off from apples in a standardized way (four circular peels with diameter of 18mm, cut off from equatorial part of the apple skin and all equally oriented). We used four sorts of apples of two different ages (one year difference). The central parts of coronas were manually deleted in order to adapt the records for the available GDV Analysis software. The parameters of the program were set as follows: remove all fragments up to 40 and background 230.

We tried to solve three different problems: classification of apples according to sort (four classes, 40 training examples of each class), according to age (two classes, 40 examples of each class), and according to the sun/shadow part of apple (two classes, 32 examples of each class). We used three different machine learning algorithms: Assistant-I, Assistant-R and the naive Bayesian classifier (Kononenko et al., 1997). We measured the classification accuracy and information score (Kononenko & Bratko, 1991). This measure eliminates the influence of prior probabilities and appropriately treats probabilistic answers of the classifier. The average information score is defined as:

$$Inf = \frac{\sum_{i=1}^{\#testinginstances} Inf_i}{\#testinginstances}$$

where the information score of the classification of  $i$ -th testing instance is defined by:

$$Inf_i = \begin{cases} \log_2 P(Cl_i) + \log_2 P'(Cl_i), & P'(Cl_i) \geq P(Cl_i) \\ \log_2(1 - P(Cl_i)) + \log_2(1 - P'(Cl_i)), & P'(Cl_i) < P(Cl_i) \end{cases}$$

$Cl_i$  is the class of the  $i$ -th testing instance,  $P(Cl)$  is the prior probability of class  $Cl$  and  $P'(Cl)$  the probability returned by a classifier.

For each problem we randomly split the available examples into 70% for training and 30% for testing set. We repeated this process 10 times and the results were averaged and the standard deviation calculated. The results are presented in Table 1.

Problem	Assistant-I		Assistant-R		naive Bayes	
	%	bit	%	bit	%	bit
sort	51.1 ± 6.9	0.73 ± 0.14	55.6 ± 4.0	0.80 ± 0.07	57.1 ± 3.1	1.01 ± 0.06
age	61.3 ± 10.7	0.21 ± 0.15	62.9 ± 6.3	0.21 ± 0.11	69.9 ± 8.9	0.40 ± 0.16
sun/shadow	48.2 ± 10.5	-0.01 ± 0.14	57.2 ± 10.8	0.10 ± 0.16	55.8 ± 4.7	0.12 ± 0.10

Table 1 Classification accuracy (%) and information score (bit) of three learning systems on three classification problems

The average information score shows that parameters contain useful information for the first two problems while for the problem of separating sun/shadow sides of the apple there is practically no useful information. The classification accuracy is rather low in all three cases but is in the first two

problems significantly higher than if the classifier would be random. Among the three classifiers the naive Bayesian classifier achieves the best results.

## Following the menstrual cycle

We recorded coronas of all ten fingertips of 13 female students in four weeks, one recording per week. Each recording was classified into one of four menstrual phases: menstruation, after menstruation, during ovulation, and after ovulation. The recordings were analysed in two ways: plotting graphs for each attribute and generating a decision tree. We wanted to test two hypotheses:

1. The corona contains useful information for menstrual cycle.
2. The map of the fingers' coronas makes sense - the particular sectors corresponding to specific organs contain useful information about the state of that organ.

A physician gynecologist explained us that menstrual cycle is strongly related with **pineal gland**, **uro-genital system**, **kidney**, and **pituitary gland**. According to Chinese medicine, kidney is connected with small finger and the other three with ring finger. Therefore, out of all 610 attributes, 8 attributes correspond, directly to these organs, 3 on each ring finger and one on each small finger.

Due to high number of attributes (610 numerical attributes are used to describe all ten corona's of fingertips) we apriori excluded 385 less interesting attributes (describing relative coefficients of sectors) and we decided to automatically select most interesting graphs (and therefore most interesting attributes) out of 225 remaining attributes.

One graph consists of 13 curves (one for each person) representing the value of a particular attribute on time scale (beginning with 'menstruation' and ending with 'after ovulation' phase). We symbolically described graphs with three bits, one bit for each pair of neighbor points. One bit describes whether the difference between two neighbour points is negative or positive. We then calculated for each graph the standard deviation of this description between 13 students and selected 15 graphs with highest standard deviation, which also had the most curves with equal 3-bit description.

Most of the selected 15 attributes were descriptions of coronas of middle and ring finger, 3 attributes described small finger and no attribute was selected for thumb and fore finger. Among the 15 selected attributes, one attribute was the area of corona's sector that corresponds to **kidney**, two attributes were areas of coronas' sectors that correspond to **pineal gland** and one attribute was the area of corona's sector that corresponds to **uro-genital system**. Therefore out of all 225 attributes where 8 may be significant the automatic procedure selected 4 significant attributes in 15 trials (the probability that this would happen by chance is less than  $10^{-3}$ ). If we take into consideration the small number of recorded students and the very low frequency of measurements (only once a week), this indicates that this result, although not reliable, supports both of our hypotheses.

The next step of our analysis was the generation of a decision tree that tries to distinguish the four phases of menstrual cycle. We had 13 times 4 = 52 training examples. Each example represented one student on one recording and belonged to one of four menstrual phases. Each example was described with 225 attributes. However, the decision tree was not able to distinguish the four phases. On the other hand, however, the algorithm selected for the second level from the top of the tree (the second most important attribute) the attribute that represents the area of corona's sector that corresponds to **pituitary gland**. Due to high number of attributes and small number of cases it could be expected that many attributes will be virtually considered as good by statistical analysis, therefore the most of selected attributes in a tree were probably selected only by chance.

## Color T-shirts

In this study we wanted to evaluate the effect of different T-shirts on the human bioelectric field. We used 4 different kinds of T-shirts: color T-shirts developed by physicist dr. Tom Chalko from University of Melbourne, Australia, 'healing' T-shirt developed by Vitalis d.o.o. from Novo Mesto, Slovenia, ordinary black and ordinary white T-shirt. The most interesting was color T-shirt, which was already tested with Kirlian camera by Chalko (1999).

We measured 5 groups of people: 115 with color T-shirt, 13 with Vitalis T-shirt, 17 with white T-shirt, 17 with black T-shirt and 25 without changing their clothes (control group). For each person all ten coronas of fingertips were recorded before putting on the T-shirt, 5, 10, 30, and 60 minutes after putting it on, and immediately after putting it off. Each person was therefore recorded six times, with an exception of 25 persons in control group, which were recorded only 5 times (last recording excluded). Each person wearing T-shirt was told in advance that T-shirt is improving the bioenergy and that it has the healing effect (we wanted to exclude the difference in the placebo effect between different T-shirts). Each person also filled a questionnaire in order to obtain other probably interesting data: age, sex, the belief in bioenergy, eventual health problems, physical and psychical feeling, color and style of current shirt etc.

The GDV images are described with a set of 610 parameters, up to 70 for one finger (see Kononenko et al., 1999 in this Volume). Experience of Prof. Korotkov (1998) and his team and of some other researchers as well (e.g. Chalko, 1999) indicates that the Area (for the purpose of comparison between different persons is more appropriate Relative Area), Brightness, Fractal Dimension, Number of Fragments, and Average Area per Fragment of the coronas of person's fingertips are directly related with human's physical as well as psychical state. The larger Relative Area, and Average Area per Fragment, and the smaller the Fractal Dimension, Number of Fragments, and Brightness the better bioelectric field and therefore the better psycho-physical state of the person.

Due to lack of space we show only a brief summary of results in Table 2. The dynamics of parameters Relative Area and Number of Fragments confirms that black and white T-shirts have no significant influence on bioelectric field, (these parameters are also stable for control group) while Vitalis and Color T-shirts do have positive influence - they improve in time both parameters. For the Average Area per Fragment the result is not so clear as for control group the parameter is monotonously increasing. For Brightness and Fractal Dimension no particular conclusion can be drawn.

parameter	black T-shirt	white T-shirt	Vitalis T-shirt	Color T-shirt	control group
Relative Area	slight.decr.	slight.mixed	monot.incr.	monot.incr.	rel.stable
Av.Area/Fragment	mixed	slight.decr.	monot.incr.	monot.incr.	monot.incr.
Fractal Dimension	rel.stable	slight.incr.	increasing	rel.stable	increasing
Num.of Fragments	rel.stable	increasing	monot.decr.	monot.decr.	rel.stable
Brightness	rel.stable	rel.stable	rel.stable	rel.stable	rel.stable

Table 2 Brief description of dynamics of different parameters for persons wearing different T-shirts

Another interesting result appeared with an experiment with generating a decision tree. We wanted to distinguish 57 persons that in the questionnaire answered that they had no health problem, from 39 persons that had the problems with throat (altogether 96 cases). We used only the data of the first recording (without the influence of T-shirts). For the root of the tree the algorithm selected, out from 75 attributes describing sectors of fingers, a sector that by Chinese medicine corresponds to

throat. There are two such sectors out of 75 sectors (the probability that this has happened by chance is  $2/75 = 0.027$ ).

## Conclusions

The three studies described in this paper showed that the GDV records, described with a set of parameters, most probably contain useful information and they are not only noise. In experiments with apples we tried to solve three different problems and in two problems it was clearly demonstrated, that the parameters that describe coronas contain useful information. In the second study, due to technical reasons we were not able yet to measure female students more often and we were not able to record larger population which would be necessary to obtain more reliable results. However, the result with automatic selection of interesting graphs (the probability that as good or better selection would appear by chance is less than  $10^{-3}$ ) indicates that it is worth to continue with this study. Current results with T-shirts show the significant effect of wearing the color T-shirt and 'healing' T-shirt on the coronas of human's fingertips.

We plan to continue studies, described in this paper, and we plan to investigate also some other phenomena:

- **Water drops:** We are trying to distinguish different kinds of water: ordinary tap water, water from various springs, water charged by a healer and water charged with various vibrations. Preliminary experiments show that it is very difficult to reliably measure the corona's of water drops.
- **'Energetic Influence' on human's corona:** We plan to measure the effect of glass bowls, coded with a certain information by Vili Poznik from Ljubljana, the effect of pyramids and natural energy source in Tunjice village near Kamnik in Slovenia on the human aura. Current results show the significant effect of holding the bowl in a hand for few minutes.
- **Pyramids:** We plan to measure their effect on the human aura and on the water. Current results show the significant effect of the pyramid that is positioned near the person.
- **Natural energy source:** We are measuring the effect of a natural energy source on the human aura. Current results show the significant effect of walking near the natural energy sources for half an hour.
- **Double coronas:** We already recorded several persons that have on at least one finger obvious double corona and the recordings were repeatable. Besides, by recording coronas of some hundreds of persons we noticed that occasionally there appears a slight tendency of double corona (which however could be ignored as noise). There is no physical explanation for this phenomenon. We talked to one expert in gas discharge, and besides being confused he said that there should be some carrier of the charge on that destination from the finger. Our current hypothesis is that the Kirlian camera is able to record only the first-level eteric body while the others are too subtle. Only in special cases, when a person has a special state of mind with emphasis on mental or emotional body, the camera is able to record this. Indeed, from our experience as well as from the experience of some other researchers from Russia, Finland, and Canada, it seems that this effect shows one of the following. The person:
  - (a) is under stress,
  - (b) has some psychic problems,
  - (c) took drugs or drunk alcohol or even inhaled benzene,
  - (d) has very disordered health state,
  - (e) is in some other way in disharmony (such as very mentally oriented person),

(f) is spiritually developed and is able to amplify higher etheric levels.

One of our colleagues always had normal (single) coronas. Once he recorded double coronas of his fingertips after one short treatment with color essences. After an hour the double corona disappeared and additional treatments with essences didn't show this effect anymore.

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