Analysis Study of Fuzzy Logic using Blood Pressure Readings

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Abstract— Fuzzy logic is a form of many-valued logic or probabilistic logic; it deals with reasoning that is approximate rather than fixed and exact. Compared to traditional binary sets (where variables may take on true or false values) fuzzy logic variables may have a truth value that ranges in degree between 0 and 1. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false. In this paper Blood pressure values has been taken as an input and applied using fuzzy algorithm. Finally we are analysing the output values.

Keywords— Fuzzy logic, Datamiing.

I. INTRODUCTION

Data mining is the process of analyzing data from different perspectives and summarizing it into useful information - information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools for analyzing data. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

II. FUZZY LOGIC AND DATA MINING

The main characteristic of fuzzy logic is that it allows us to define values without specifying a precise value, something which is not possible with classical logic, upon which computer development has been based so far. In classical logic,the membership to one class or set is binary, i.e., one is
either member or not, so that only two precise values are worked with (1 and 0, yes or no). Thus, if ''very low pH'' is defined for some samples, it is evident that a sample with pH2 belongs to the cluster and another one with pH 6 does not, but how do we classify a sample with pH 4.99? It is precisely in the answer to this kind of question where classical logic shows its limitations to us. Fuzzy logic allows us to associate each sample with a certain degree of fulfilment of the ''very low pH'' prototype. This grade is called ''membership grade'' lVLpH (x) of the element x 2 X to the set ''very low pH''[2].

A. Blood Pressure

Blood pressure is typically recorded as two numbers, written as a ratio like this:

Diastolic. The bottom number, which is also the lower of the two numbers, measures the pressure in the arteries between heartbeats (when the heart muscle is resting between beats and refilling with blood).

B. Causes of Blood Pressure

Blood pressure is the measure of the force of blood pushing against blood vessel walls. The heart pumps blood into the arteries (blood vessels), which carry the blood throughout the body. High blood pressure, also called hypertension, is dangerous because it makes the heart work harder to pump blood to the body and contributes to hardening of the arteries, or atherosclerosis, and to the development of heart failure.

C. Normal Blood Pressure

A blood pressure reading has a top number (systolic) and bottom number (diastolic). The ranges are:
Normal: Less than 120 over 80 (120/80)
Pre hypertension: 120-139 over 80-89
Stage 1 high blood pressure: 140-159 over 90-99
Stage 2 high blood pressure: 160 and above over 100 and above. People whose blood pressure is above the normal range should consult their doctor about steps to take to lower it.

D. Causes for high Blood Pressure

The exact causes of high blood pressure are not known, but several factors and conditions may play a role in its development, including: smoking, being overweight or obese Lack of physical activity, Too much salt in the diet, Too much alcohol consumption (more than 1 to 2 drinks per day), Stress, Older age, Genetics, Family history of high blood pressure, Chronic kidney disease, Adrenal and thyroid disorders.

E. Essential Hypertension

In as many as 95% of reported high blood pressure cases in the U.S., the underlying cause cannot be determined. This type of high blood pressure is called essential hypertension. Though essential hypertension remains somewhat mysterious, it has been linked to certain risk factors. High blood pressure tends to run in families and is more likely to affect men than women. Age and race also play a role. In the United States, blacks are twice as likely as whites to have high blood pressure, although the gap begins to narrow around age 44. After age 65, black women have the highest incidence of high blood pressure.

Essential hypertension is also greatly influenced by diet and lifestyle. The link between salt and high blood pressure is especially compelling. People living on the northern islands of Japan eat more salt per capita than anyone else in the world and have the highest incidence of essential hypertension. By contrast, people who add no salt to their food show virtually no traces of essential hypertension. The majority of all people with high blood pressure are "salt sensitive," meaning that anything more than the minimal bodily need for salt is too much for them and increases their blood pressure. Other factors that can raise the risk of having essential hypertension include obesity; diabetes; stress; insufficient intake of potassium, calcium, and magnesium; lack of physical activity; and chronic alcohol consumption.
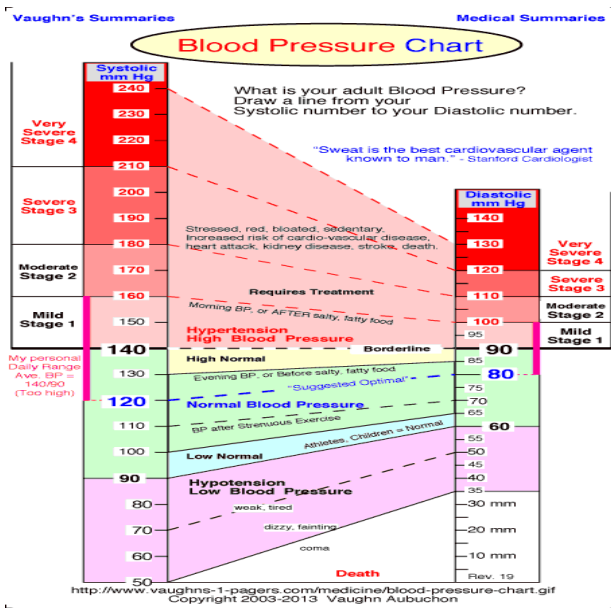

Fig. 1 A sample medical blood pressure chart.

What is **Normal Blood Pressure**? Buy and use an *automatic blood pressure monitor*. Compare your BP reading with the numbers on the chart above. Draw a line from your systolic pressure to your diastolic pressure. Is the slope of the line about the same as shown on the chart? Where do YOU fit in? What are your risk factors? Are your blood pressure readings within the normal blood pressure range? Should you take anti-hypertension medication to lower your blood pressure? Normal human daily Blood Pressure Range can vary widely, so any single blood pressure monitor reading is not reliable. BP monitor readings must be taken at different times of day, to determine AVERAGE blood pressure levels over time.

F. Blood pressure measures the force pushing outwards on your arterial walls.

The organs in your body need oxygen to survive. Oxygen is carried through the body by the blood.

When the heart beats, it creates pressure that pushes blood through a network of tube-shaped arteries and veins, also known as blood vessels and capillaries. The pressure --- blood pressure --- is the result of two forces. The first force occurs as blood pumps out of the heart and into the arteries that are part of the circulatory system. The second force is created as the heart rests between heart beats. (These two forces are each represented by numbers in a blood pressure reading.) .

   1) HBP damages arteries: There are two root causes of erectile dysfunction (ED): psychological and medical. High blood pressure is a contributing medical factor that leads to ED. HBP damages the entire vascular system*[2]*.

   2) Adequate blood flow is necessary for erection : Because effective blood flow through the arteries and veins is essential to achieve and sustain an erection, any problem that impairs blood flow can cause ED. A number of medical causes associated with erectile dysfunction are problems with the arterial system.

III. DATASET

This chart reflects blood pressure categories defined by the American Heart Association

Blood Pressure Category	Systolic mm Hg (upper #)		Diastolic mm Hg (lower #)
Normal	less than **120**	and	less than **80**
Prehypertension	**120 – 139**	or	**80 – 89**
High Blood Pressure (Hypertension) **Stage 1**	**140 – 159**	or	**90 – 99**
High Blood Pressure (Hypertension) **Stage 2**	**160** or higher	or	**100** or higher
Hypertensive Crisis **(Emergency care needed)**	Higher than **180**	or	Higher than **110**

Fig. 2 A sample chart refers BP categories defined by American heart association.

A single high reading does not necessarily mean that you have high blood pressure. However, if readings stay at 140/90 mm Hg or above (systolic 140 or above OR diastolic 90 or above) over time, your doctor will likely want you to begin a treatment program. Such a program almost always includes lifestyle changes and often prescription medication for those with readings of 140/90 or higher. If, while monitoring your blood pressure, you get a systolic reading of 180 mm Hg or

higher OR a diastolic reading of 110 mm HG or higher, wait a couple of minutes and take it again. If the reading is still at or above that level, you should seek immediate emergency medical treatment for a hypertensive crisis. If you can't access the emergency medical services (EMS), have someone drive you to the hospital right away. Even if your blood pressure is normal, you should consider making lifestyle modifications to prevent the development of HBP and improve your heart health[2].

High blood pressure, also known as HBP or hypertension, is a widely misunderstood medical condition. Some people think that those with hypertension are tense, nervous or hyperactive, but hypertension has nothing to do with personality traits. The truth is, you can be a calm, relaxed person and still have HBP.

Let's look at the facts about blood pressure so you can better understand how your body works and why it is smart to start protecting yourself now, no matter what your blood pressure numbers are.

By keeping your blood pressure in the healthy range, you are: Reducing your risk of the walls of your blood vessels walls becoming overstretched and injured. Reducing your risk of having a heart attack or stroke; and developing heart failure, kidney failure and peripheral vascular disease. Protecting your entire body so that your tissue receives regular supplies of blood that is rich in the oxygen it needs.

Damaged arteries cannot deliver adequate blood flow to the body's organs. The organs suffer because they do not receive a full supply of blood, which they depend on for oxygen and nutrients. So over time, not only are the arteries unable to function properly, but the organs can't perform as they should either.

When arteries are narrowed by fatty deposits, you have a greater risk for developing blood clots. Your blood can carry these clots until they become lodged in narrow spaces. When this happens, the clot can significantly or completely block the blood supply to parts of the body.

4) HBP damages arteries:

Stroke is a disease that affects the blood vessels that supply blood to the brain. A stroke occurs when a blood vessel to the brain is either blocked by a clot (ischemic stroke) or bursts (hemorrhagic stroke). When that happens, part of the brain is no longer getting the blood and oxygen it needs, so it starts to die. Your brain controls your movement and thoughts, so a stroke doesn't only hurt your brain. It also hurts the brain's ability to think and control body functions. Strokes can affect language, memory and vision as well as cause paralysis and other health issues.

| 2. Blood Pressure Range Notes		
Normal Blood Pressure		
BP Readings Range		
Systolic	**Diastolic**	**HIGH Blood Pressure Symptoms** Stressed, Sedentary, Bloated, Weak, Failing
210 - 240+ 180 - 210 160 - 180 140 - 160	125 - 140+ 110 - 125 100 - 110 90 - 100	**Stage 4 High Blood Pressure** **Stage 3 High Blood Pressure** **Stage 2 High Blood Pressure** **Stage 1 High Blood Pressure**
140 130 **120** 110 100	90 85 **80** 70 65	**BORDERLINE HIGH BP** High Normal **NORMAL Blood Pressure** **Low Normal** **Low Blood Pressure**
90 80 70 60 50	60 55 45 35 30	90 - 60 - Very Low BP **80 - 55 - Extremely Low BP** **70 - 45 - Danger** **60 - 40 - Danger** **50 - 30 - DANGER LOW**
		LOW Blood Pressure Symptoms - Weak, Tired, Dizzy, Fainting, Coma

Fig. 3 Blood Pressure Values

Reference ranges for blood pressure

Stage	Approximate age	Systolic	Diastolic
Infants	1 to 12 months	75–100[19]	50–70[19]
Toddlers	1 to 4 years	80–110[19]	50–80[19]
Preschoolers	3 to 5 years	80–110[19]	50–80[19]
School age	6 to 13 years	85–120[19]	50–80[19]
Adolescents	13 to 18 years	95–140[19]	60–90[19]

Fig 4.Reference ranges for blood pressure

IV. CONCLUSION

The BP values are taken as an input using fuzzy logic. Finally the values are compared together using fuzzy technique. This diagram shoes the output of the implementation . In future we have planned to implement data mining algorithms to mine

fuzzy association rules, a machine learning component may be implemented.
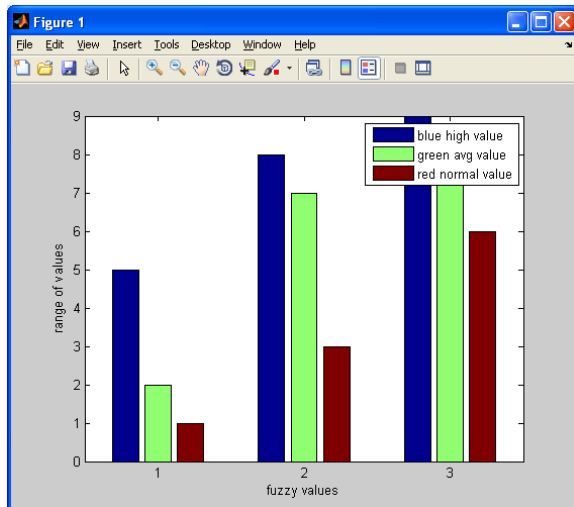
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