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# Analog Intelligence Approach to Human Augmentation

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## ABSTRACT

As resources are running out, we cannot sustain the current Industrial Society anymore. We need to develop a new world for the next generation. But the real world is changing extensively, which we have never experienced. Therefore, we have no tools other than our instinct. However, if we introduce Reservoir Computing, it enable us to introduce micro technology and we can make sensors and actuators extremely small, so that we can make them part of our body. In short, we can enhance our instinct and it helps us augment our human capability, and adapt to the drastically changing real world in real time. To process this analog information, a new approach is developed which is based on hierarchical cluster analysis.

**Keywords:** Resource depletion, End of the industrial society, Society never experienced, Maximizing use of instinct

## INTRODUCTION

This paper points out the increasing importance of "Heart" in the next generation. We should remember remember that even if our brain stops working, death is not sentenced. The true death comes when our heart stops and blood does not flow.

Brain processes digital information. Digital information is dicrete and scientific. And it is finite and roproducible. Heart processes, on the other hand, analog information. Analog information is continuous and infinite. It is more related to engineering. Or in other words, it is pragmatic.

Maslow clarified human needs (Maslow, 1943), (See Figure 1).

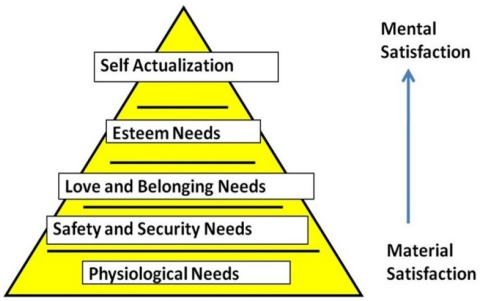


**Figure 1:** Maslow's hierarchy of human needs.

Just as in other animals, humans tried to satisfy their materal needs first. But human need shifts to mental with time. And at the final stage, humans look for self-actualization.

But Maslow does not discriminate heart, brain and mind. Brain processes information which comes from outside, based on knowledge, which is the structured accumulation of personal experience. We should note that there are two kinds of knowledge. One is personal and the other is universal and generally applicable. The latter is associated with science and the former is associated with engineering. The former emphasizes the importance of process.

We are born to enjoy a challenge. It motivates us. In the latter, the result counts. How is important. What plays an important role in the former.

Mind is related to heart and brain. To describe it briefly, it is decision making. Both brain and heart work for decision making, although their goals are different. As everybody knows, our society changes from one to another with time (See Figure 2).

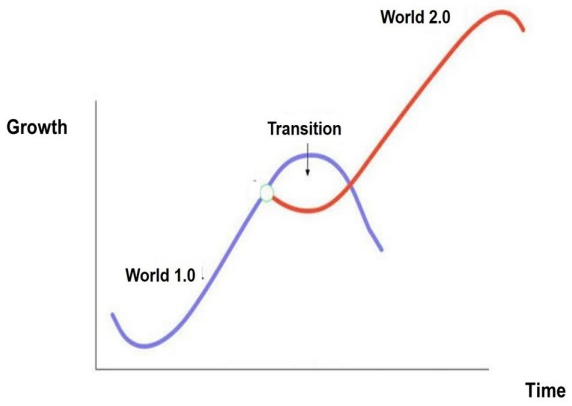


**Figure 2**: Society shifts with time.

The current society is the Industrial Society. It is introduced by the Industrial Revolution, which originated from our desire to relieve us from labor.

It succeeded from this standpoint. Many products have been developed to lessen our physical burdens. But this success was brought forth because changes were smooth yesterday so we could differentiate them and predict the future. But today, changes become very sharp. So we cannot differentiate them anymore. Tomorrow becomes unpredictable. In addition. The real world itself becomes unknown which we never experienced.

It is pointed out here that "Instinct" plays an important role to deal with this world.

## HOW TO MAKE THE MOST OF INSTINCT

Then how can we make the most of instinct to achieve this goal?

We developed an approach in our previous study of detecting emotion from face (See Fukuda et al., 2001), (See Figure 3).

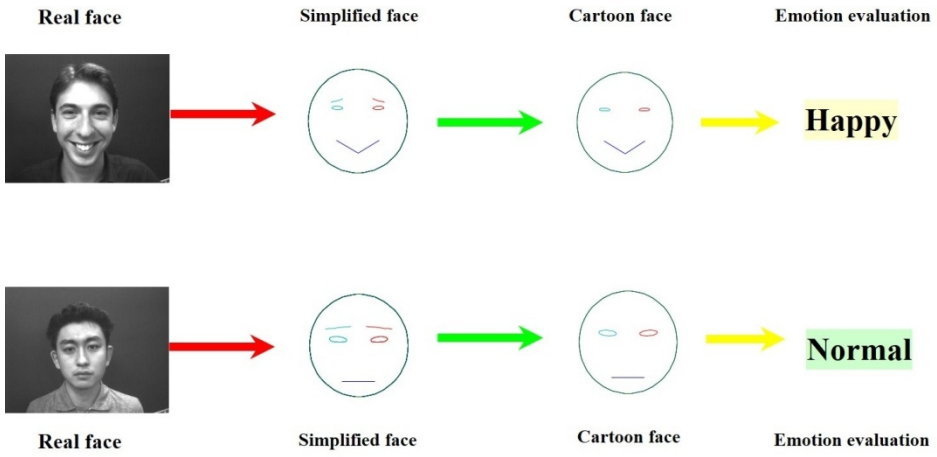


**Figure 3:** Cartoon face model.

## Mahalanobis Distance Interval Scale and Ordinal Scale

In science, Euclidean Space is used. In other words, it is interval scale and orthonormaliy and distance with unit are required. But what we need to make the most of our distance is ordinal scale. We need to prioritize our decisions.

## Mahalanobis Distance

At first, we tried many image processing techniques. But they took too much time and did not produce satisfactory results. Then, during these challenges, Fukuda suddenly realized that when we see a cartoon, we can detect the emotions of their characters at once, even in black and white and even when only one cartoon is shown. We suddenly realized the importance of pattern. Therefore, at first, we tried many image processing techniques. But they took too much time and did not produce satisfactory results. Then, during these challenges, Fukuda suddenly realized that when we see a cartoon, we can detect the emotions of their characters at once, even in black and white and even when only one cartoon is shown. We suddenly realized the importance of pattern. Thereforewe introduced cartoon face mode based on patterns and comparing the real face with these patterns, we succeeded in detecting emotion from face without any time delay. Mahanabois developed "Mahalanobis Distance" to remove outliers from his design of experiment data sets (Malahanobis, 1936). This is ordinal scale. So, we can utilize it for prioritizing decisions.

## Dynamic Pattern Matching

But if we can introduce hierarchical cluster analysis, we can understand how they are different. In short, we can introduce meta-level difference between the learners. We can make it more comprehensive and we can use it as a means

of communication. It can be used for understanding customers expectations. We can detect what really catches their heart. Thus, we can use this approach for marketing in the broad sense.

## FINAL REMARK ON HUMAN FACTORS

There are two kinds of human factors. One is easily detected from outside.Thus, we can detect parameters and control them. The other is related to inside of our body such as muscles. We cannot understand how they work together. Thus, we need "Coordination" to make them work as you wish.

In fact, William Maslow made a poem "My heart leaps up when I behold a rainbow in the sky". We cannot tell when the rainbow comes up and when we do see a rainbow, our "Heart" leaps up. It touches our "Heart", not brain.

Once again. We should pay more attention to our "Hearts" when we discuss Human Factors.

As the current Industrial Society consumers too much energy, we cannot sustaChin it anymore. Even Ai consumes a lot of energy, so it does not solve the problem. We should pay more attention to our "Hearts" and make our life siimple to really enjoy life. Simple life, yet a great amount of enjoyment is what we need to consider as an increasingly important challenge in Human Factor.

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