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Shuichi Fukuda

World 2.0

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Preface

A word to the reader is

“We worked for industry. Now, it is time industry works for us”

This is the main core message of this book.

Current engineering framework since the Industrial Revolution is now approaching its ceiling. And many issues are emerging, such as decreasing workforce, aging population, decreasing childbirth, and decreasing energy. Then, we should explore the new engineering, which will solve these issues and more than that, which enables us to enjoy our own life.

The following are main ideas described in this book:

- (1) Human life and machine life are separated. But if we notice that humans and machines live the same way. Both learn to grow and work, then, age. In machines, learning to grow is called break in or fit. And aging is called deterioration. But whatever we may call them, their life is basically the same.
- (2) Changes yesterday were smooth so that we could differentiate them mathematically and predict the future. Thus, we could focus on products and paid our efforts to update the functions of a final product. Control was the keyword. Our main efforts were paid to solve the problem faster and with better cost performance.

But today changes are sharp, so we cannot predict the future. Thus, “Adaptability” is getting wide attention. But to achieve our goal, we should do more than to adapt. We need to win the game against the real world.

- (3) As IoT pointed out, we used to work outside of the system, but to cope with the frequent, extensive, and unpredictable changes, we need to be a playing manager and must be on the pitch. We need to work together with machines on the same team.

But as soccer demonstrates, other players (machines and humans) must communicate with the playing manager and must be prepared in advance for the next action, which vary widely from situation to situation. In a word, they must be proactive.

- (4) What can work for a communication tool between humans and machines, and between machines and machines? It is movement. Humans and machines share movements.
- (5) In traditional engineering, results or outcomes are important. And how to produce them is important. So, the goal is fixed. It is problem solving and tactics. Reproducibility is important. But in frequently, extensively, and unpredictably changing environments and situations, problem finding is important. Or to express it another way, motivation is important. So, all's well that ends well. We do not care too much how we get to the goal. Reaching the goal is most important. In short, "Pragmatism" will be the philosophy for the next generation engineering.
- (6) Traditional engineering was product-oriented and the producer was playing the leading role. Product value was most important. But next engineering will focus primarily on humans. How we can satisfy human needs is the challenge. Challenge is the core and mainspring to all human activities. Thus, we need to proceed by trial and error. Life is a game.
- (7) Self-Actualization is the highest human need and growth is another important human need. If we pay more attention to "Self", we may be able to expand the new horizon further. And what is important is "Self" engineering not only satisfies needs of individual persons, but it also satisfies the need for human species to expand their world.
- (8) To explore such a world, we need to tackle with the problem of computational complexity. But if we observe the octopuses, they die soon after their babies are born. So, they do not inherit knowledge from the previous generation. They live on their own instinct alone. But they can negotiate any environments and situations, and they escape. They are known as "Expert of Escape". But did we consider instinct in our engineering? I would say "NO". We have been paying attention to brain too much and forgot completely about instinct. But babies learn to move and walk without any textbooks. They use their instinct to learn and grow. If we can use our instinct more, we can tackle with the real world more flexibly and expand our horizons more rapidly and easily.
- (9) To achieve such a goal, we need a holistic and quantitative performance indicator to learn how we can improve our performance.
- (10) Most of current engineering is based on Euclidean Space approach. It requires orthonormality and units. So, for a small number of dimensions, they work very well, But if dimension increases, it becomes extremely difficult to apply these approaches. Thus, Mahalanobis Distance-Pattern (MDP).

Approach is proposed. Mahalanobis Distance is Non-Euclidean Space approach and it is free from the constraints of orthonormality and units. And it is primarily proposed to identify the outliers. And pattern works for holistic perception.

With the help of this MDP approach, it is expected that we can expand the horizon more easily and establish a new engineering, which provides us with the pleasurable and enjoyable life.

I hope you will read another SpringerBrief of mine, “Self Engineering: Learning from Failures”. Together, I believe you will understand my messages clearly. And each chapter of this book is self-inclusive. So, enjoy reading chapters that interest you.

I would like to thank many people for providing me with very different perspectives. I hope we can open the door together to the new world of the next generation engineering.

Finally, I would like to thank Mr. Anthony Doyle and Mr. Werner Hermens, Springer and Mr. Balaganesh Sukumar and Ms. Megana Dinesh, SpringerNature. Their encouragement and patience are truly appreciated.

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