Chapter 10

MentalSquares: An Equilibrium-Based Bipolar Support Vector Machine for Computational Psychiatry and Neurobiological Data Mining

ABSTRACT

While earlier chapters have focused on the logical, physical, and biological aspects of the Q5 paradigm, this chapter shifts focus to the mental aspect. MentalSquares (MSQs) – an equilibrium-based dimensional approach – is presented for pattern classification and diagnostic analysis of bipolar disorders. While a support vector machine is defined in Hilbert space, MSQs can be considered a generic dimensional approach to support vector machinery for modeling mental balance and imbalance of two opposite but bipolar interactive poles. A MSQ is dimensional because its two opposite poles form a 2-dimensional background independent YinYang bipolar geometry from which a third dimension – equilibrium or non-equilibrium – is transcendental with mental fusion or mental separation measures. It is generic because any multidimensional mental equilibrium or non-equilibrium can be deconstructed into one or more bipolar equilibria which can then be represented as a mental square. Different MSQs are illustrated for bipolar disorder (BPD) classification and diagnostic analysis based on the concept of mental fusion and separation. It is shown that MSQs extend the traditional categorical standard classification of BPDs to a non-linear dynamic logical model while preserving all the properties of the standard; it supports both classification and visualization with qualitative and quantitative features; it serves as a scalable generic dimensional model in computational neuroscience for broader scientific discoveries, and it has the cognitive simplicity for clinical and computer operability. From a broader perspective, the agent-oriented nature of MSQs provides a basis for multiagent data mining (Zhang & Zhang, 2004) and cognitive informatics of brain and behaviors (Wang, 2004).
INTRODUCTION

Mind reading is a stunning achievement in brain research (Singer, 2008). Now scientists can accurately predict which of thousands of pictures a person is looking at by analyzing brain activity using functional magnetic resonance imaging (fMRI). Mind reading should shed light on how the brain processes visual information, and it might one day be used to reconstruct dreams. On the other hand, event-related potential/electroencephalography (EPR/EEG) technology is being intensively studied for event-related (versus image-related) brain research for furthering the understanding of human intelligence.

Despite numerous great achievements in brain research, some mental health problems such as bipolar disorder (BPD) remain at the top of the list of major diseases that have so far found no cure (Kessler et al., 2006). The difficulty of finding a cure for BPD is even recorded in the Bible. It is described as being caused by some ghostly spirit; sometimes one patient could get several such spirits; and only Jesus could cure the disease by ordering the ghostly spirits to go away.

Modern medicine shows that BPD is psychiatric disease caused by neurobiological or genetic reasons. Since millions suffer from major depressive and bipolar disorders, the modeling, characterization, classification, and diagnostic analysis of such mental disorders bear great significance in medical and pharmaceutical research. Scientifically speaking, bipolar neurobiological data mining from uncharted territories bring unprecedented challenges to data and knowledge engineering.

Following the theory of bipolar agents and YinYang bipolar relativity, bipolarity as the most fundamental property of nature is not necessarily a bad concept because YinYang bipolar relativity claims that we are all bipolar, either in bipolar equilibrium or in bipolar disorder. Thus, BPD is the loss of bipolar order or equilibrium. It is neither caused by a ghostly spirit nor caused by a “mental big bang” or “black hole” from nowhere. The purpose of a therapeutic intervention is then to recover the disorder to a healthy energetic bipolar mental equilibrium such as the reciprocal mental balancing abilities denoted (self-negation, self-assertion) of a person. Psychiatric education, therefore, should stress the importance of understanding the bipolar nature of agents and promote YinYang bipolar mental equilibrium for mental health in a bipolar world.

For instance, YinYang bipolar thinking can help people maintain mental equilibrium by exercising positive thinking when depressed and exercising negative thinking when excited. Such YinYang bipolar thinking is actually common public knowledge of emotional intelligence practiced everyday by millions of people in the world. Otherwise, more people would suffer from depression or bipolar disorder.

The theory of bipolar agents and bipolar relativity opened the door for applying mental quantum gravity in mental health research, which can be deemed an extension of brain research with the addition of bipolar quantum entanglement and equilibrium. Theoretically, the extension brings brain dynamics and quantum gravity into the equilibrium-based logical unification of bipolar relativity. Practically, the extension provides brain research with a real world context of bipolar agents, bipolar functionality, and bipolar behaviors, respectively, such as negative and positive particles, matter and antimatter, action and reaction, depression and mania, self-negation and self-assertion abilities, etc.

Naturally, we need to ask the question: If our brain is considered a neurobiological universe, how does the universe interact with its bipolar equilibrium and non-equilibrium context? Thus, the bipolar context, with logically definable causality and relativity, provides a test bed for actual or potential applications in clinical psychopharmacology, computational neuroscience, psychiatry, and nano-biomedicine for mental health. Theoretically speaking, the context provides an environment for the falsifiability of quantum mind theory as well as bipolar causality and relativity.
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