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A Combinatorics Approach to Pattern Recognition of

2

Bitarray Datastreams

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Theo Portlock

4

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Abstract

In our lives, we try to make decisions that increase the possibility of moral outcomes. We judge others by their moral objectives and their adherence to them. Identifying, understanding, and mitigating the flaws of human thought process and decision making is essential for human progress. Despite much progress made in the field of artificial intelligence, a tool that makes better, more informed moral decisions than a human has not been developed and is the aim of this study. A novel approach that involves the field of combinatorics to bitarray datastreams with a likeness to the neuronal communication in the brain was developed to achieve these ends. The possibility of succeeding is incalculable but increases with effort, time, and expertise. However, if good progress towards these aims are made, the consequences will pave the way for the future of a more moral society.

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Chapter 1

Introduction

1.1 Morality

Morality is the principles that define right and wrong actions. A moral agent acts according to moral systems. In a moral system, an event is considered morally good if its consequences increase the probability of a moral end.

1.1.1 Moral origins

Moral systems can be described as natural or non-natural in origin. Natural morals are those that are installed without observation. A proportion of all moral agents will act randomly. Actions that are observed implies that those actions did not result in the death of the other individual. This filter ensures that random actions that result in death are not observed and are therefore not continued. Non-natural morals are those that are installed from observation.

1.1.2 Moral relationships - Interaction between two moral systems

Moral ends vary between individuals. The morality of others and their moral compatibility can be only be predicted from a record of past actions. When individual moral agents interact, one of three

possible interactions can be observed. Firstly, a Rejective interaction manifests as an assumption that each other's actions are bad (-/-). Secondly, an Assymetric interaction is a consequence of the willingness of only one moral agent to encourage the others pursuit of their respective moral systemi (+/-). Lastly, an Acceptive interaction is the understanding that the ends described by a moral system converges to the point that their continued actions weighted by their estimated probability is similar to those actions taken by the moral system of another individual (+/+).

1.1.3 Moral consensus - Majority moral opinion

An estimation of common "good" is essential for collective progress. The search for this consensus is done at a personal or a collective level when we vote, poll, or protest. An estimation of common "good" is also necessary for collective arbitration of an action; a field referred to as descriptive or comparative ethics. Once a consensus is established, the application of the golden rule, the principle of treating others as you wish to be treated, forms the basic principles of justice and social contract. Communication of intention can often be reciprocal, that is to say one individual has and understanding of the others understanding of your understanding (and so on). An understanding of the consequences of breaking this rule encourages the enforcement of a social contract. The lesser the amount of knowledge surrounding subject matter, the greater the room for reasonable disagreement. Factual consensus has no claim to moral authority.

1.1.4 Moral evolution - How morality changes over time

Consensus morality changes over time. Although opinions of an action can be changed by a greater understanding of probabilities of consequences that arise after the action, morals are unaffected by facts. Moral re-evaluation is also possible through the revelation of inconsistencies. The cause of this can be due to incomplete data relating to a moral question or cognitive dissonance.

1.2 The state of current majority moral opinion

Although the secularisation of western countries and adoption of enlightenment ideals is often considered a loss of moral congruency, the opposite is most likely as a consequence of interreligious

118 moral alignment. Based on polling data, core moral principles include:

119 1.2.1 How is society improving?

120 With respect to the current moral consensus, there has been significant moral progress¹.

121 1.2.2 How is society deteriorating?

122 1.3 Fallibilities and limitations of human decision making

123 In all humans there is a preinstalled moral operating system referred to as natural morality. This
124 system has evolved to promote reproduction and survival. Consensus morality today is different
125 from natural morality In order to suppress these naturalistic urges and reverse these forms of societal
126 deterioration, it is important to look at the origins. The pursuit of overcoming these urges is one
127 which we should all share².

128 1.3.1 Bias and Discrimination, Misinformation, and Information deficit

129 1.3.2 The scale of human computation

130 With the advancements in electronic data storage, the availability of data brings with it the
131 potential for more accurate predictive tools than any point previously. However, the current
132 restraints of human computational load limits the rate at which these tools can be utilised.

133 1.4 Alternative decision making algorithms

134 Computation makes decisions Currently, there has been no success in the construction of an
135 artificial moral agent that mitigates the real issues in human moral decision making process.

136 1.4.1 Deep learning

137 1.4.2 HTM

138 Numenta³, alpha go, etc

139 1.4.3 How to align intelligent systems with consensus moral beliefs

140 As with humans, if an agent has greater intelligence then there is a greater importance that the
141 agent has a moral system that aligns with the core values that supports the current majority moral
142 opinion. Transparency of decision making process is crucial for the public arbitration of artificial
143 decision making algorithms;

144 1.5 AI safety and responsibility

145 1.6 Project aims

146 Current attempts have fallen short at achieving these ends and resulted in hyperspecific reward
147 seeking behaviour. The aim of this study is to leverage the advancements of computing to create a
148 system that will make more moral choices than those made by a human. Separate from traditional
149 neural network architectures, Hirachical Temporal Memory (HTM) is a technique developed by
150 Numenta that more closely resembles the connections between axons in the brain. In this study,
151 the guiding principles of HTM combined with a novel system for self validation will be designed
152 to evaluate *ab initio* learning of a new machine learning model. Python will be used principally
153 for development, testing, and validation.

154 **Chapter 2**

155 **Input**

156 **2.1 Sources of data**

157 **2.2 Binary conversion**

158 **2.3 Sparsity**

159 **2.4 Tandem data input**

Chapter 3

Output

3.1 How are decisions made

Decision field theory is a method of mathematically modelling the change in utility when comparing multiple choices⁴. Currently, machines do not act this way.

3.2 The random-pianist method

3.3 The Upgrade workflow

No delayed combinations only reinforce if you see it multiple times I = input that does not result from an action A = input that results from an action R = random input (or choice of previous set: pseudorandom) [] = combination expansion Both the action and the actions effects should be recognised by combinations

I1, R1 → A1[I1, R1] I2, A1, R2 → A2[I2, A1, R2] I3, A2, R3 → A3[I3, A2, R3] I4, A3, R4 → A4[I4, A3, R4]

Aims: 1: Learn actions from inputs 2: Decrease entropy from the UEI 3: Learn inputs from inputs

174 Whats being combined for each timepoint: Random doping I1, R1 I2, R2, A1[I1, R1] I3, R3,
 175 A2[I2, R2, A1[I1, R1]] ...

176 actions included I1, A1 I2, A1(I1) I3, A2(I2), A2(A1(I1)), A2(I2 + A1(T1))

177 W/O random doping I1 I2, A1[I1] I3, A2[I2, A1[I1]] ...

178 expanded W/O random doping I1 I2, A1(I1) I3, A2(I2), A2(A1(I1)), A2(I2 + A1(T1)) ...

179 translated: new input the action resulting from the second input the action resulting from the
 180 action resulting from the first input the action resulting from a combination of the second input
 181 and the action resulting from the first input

182 R1, I1, A1

Chapter 4

Memory

4.1 Classical combinatorics

4.2 The combination problem of scale

4.3 Slicing the combinations array

4.3.1 Combinations of combinations

4.4 Storage

4.5 Prediction

4.6 Persistence of activation

4.7 Edge contraction

4.8 Delay function

196 Chapter 5

197 Runtime

198 5.1 Chapter introduction

199 Chapter 6

200 Testing

201 6.1 Chapter introduction

202 This chapter will focus on some of the more well known problems that face current machine
203 learning models. As opposed to traditional testing nomenclature in software design (unit testing,
204 integration testing), I will refer to all forms of experimentation as testing (such as Turing testing).

205 **6.2 Test 1 - Parrot**

206 **6.3 Test 2 - Mathematics**

207 **6.3.1 True/False**

208 **6.3.2 Addition**

209 **6.3.3 Sine prediction**

210 **6.3.4 Modelling and the stock market**

211 **6.4 Test 3 - Natural language modelling**

212 **6.4.1 Text prediction**

213 **6.5 Test 4 - Sound signal processing**

214 **6.5.1 Voice recognition**

215 **6.6 Test 5 - Image classification**

216 **6.6.1 Breast cancer tissue classification**

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