The Study of Game Theory on Graph

So Okawara

November 29, 2023

1 Introduction

Given each vertex v_i on the graph X has its *benefit* $p_i(v_i)$, an *input* $a \in v_i$ could convey *signal* x_a to v_j by distribution of strategies $p_n \in v_n$.

I.g., it could be optimised by DL for the given set of inputs $a_n \in A$ and its entries $v \in V$, to know the tendency in A or V; like the network of financial system for the outer stimuli like the official discount rate. The second example is for *topography* model of psychology by Freud, in more minute vertices, to model the unconsciousness. The third example is *ecosystem* in general against any change outside.

In metaphor, if the pinball has *Freud's pleasure principle* for the gross benefit p^* as the score board on it, with the players as the environment to fit in, by learning the distribution of the springs dynamically; the pinball could have say it owns the mind to grow against the coming players, by *conflict* among the springs set aside.

By this topography, i.g., conflict like ambivalent interpretation becomes possible like the image of a woman "beautiful" on topos v_1 while "dangerous" on topos v_2 with deciding how to output in the gross benefit p^*.

2 On PyTorch

As the easier case than AI, we firstly model the ideal financial market.

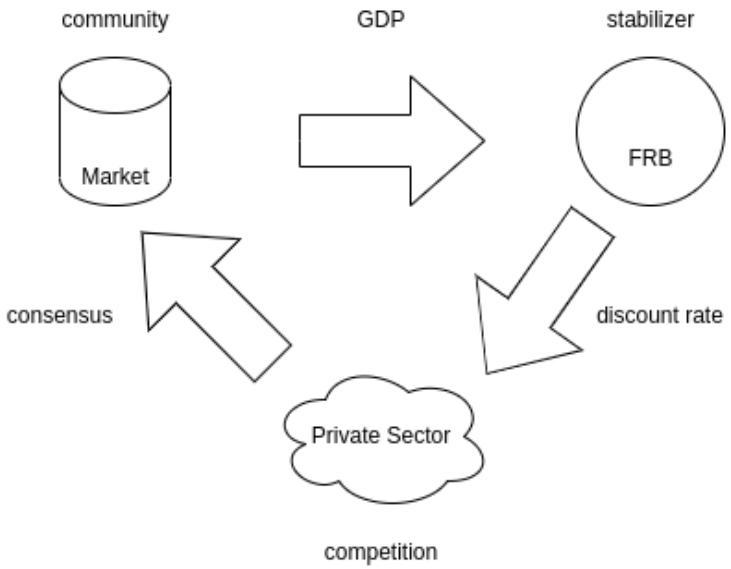

Figure 1: The ideal financial market

which could be a metaphor to the Freudian metanl model.

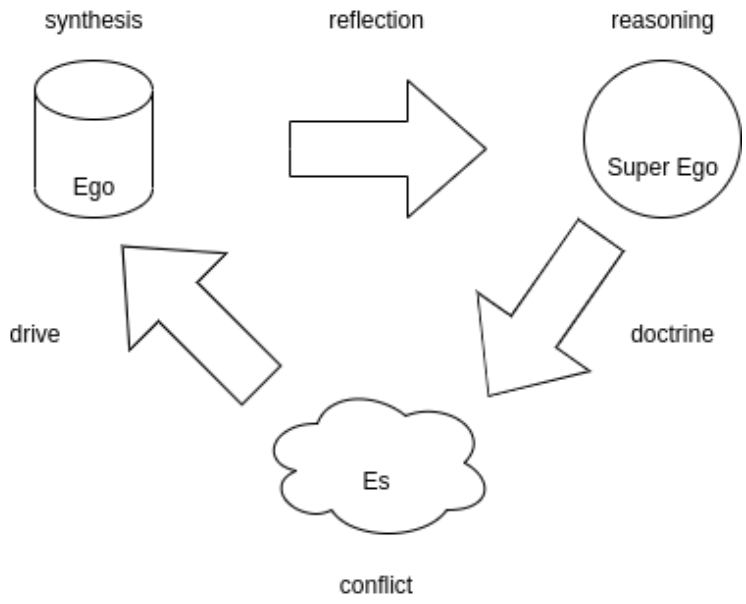

Figure 2: The Freudian Topography

The weight matrix W be on the cloud of private competitors;

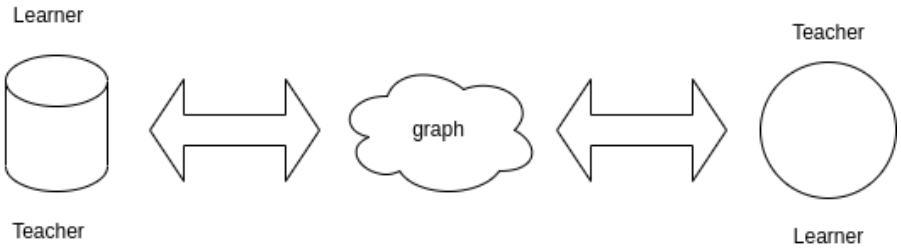

Figure 3: Ping-pong Model

3 In Theory

Path-dependency best response function

$$B_i(a_{-i}) = \{a_i \in A_i : u_i(a_i, a_{-i}) \geq u_i(a_i\prime, a_{-i}), \forall a_i\prime \in A_i\}$$

Cournot's oligopoly Game

$$\pi_i(q_1, \cdots, q_n) = q_i P(q_1 + \cdots + q_n) - C_i(q_i)$$

The War of Attrition

$$u_i(t_1, t_2) = \begin{array}{lll} -t_i & if & t_i < t_j \\ \frac{1}{2}v_i - t_i & if & t_i = t_j \\ v_i - t_j & if & t_i > t_j \end{array} \tag{1}$$

Accident Game

$$-a_i - \rho(a_1, a_2)L(a_1, a_2)$$
$$-a_2 - (1 - \rho(a_1, a_2)L(a_1, a_2))$$

References

[1] An Introduction to Game Theory, Martin J. Osborne, 2000.