A STUDY OF RELIGIONS

CS785A - Multi Agent Systems

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THE PROBLEM STATEMENT

- Model inter-religion interaction
- Interaction as co-operation and defect

ITERATED PRISONER'S DILEMMA

	C	D
C	d,d	c,b
D	b,c	a,a

Figure: Prisoner's dilemma payoff matrix

- b > d > a > c
- Widely used to model co-operation in society
- Game played repeatedly to capture evolution of co-operation

CAPTURING BELIEF SYSTEMS

Religion: My actions will have repercussions

- q_c : probability of being punished for co-operating
- q_d: probability of being punished for defecting

Taken as Gaussian Distributions

UTILITY SHOCK

- Following the strategic interaction, each individual believes he will receive, in addition to the payoff of the PD game, either a negative utility shock, -ϵ, or a positive utility shock, ϵ.

CAPTURING PRE-CONCEIVED NOTIONS

- What one religious organization expects from the opponent religious organization
- b_i : probability that the opponent will co-operate
- b_i modified after every iteration of game: increased by α if opponent co-operated, decreased by α if opponent defected

FINAL MODEL

	C	D
C	$d+\epsilon(1-2q_c), d+\epsilon\prime(1-2q_c\prime)$	$c+\epsilon(1-2q_c), b+\epsilon\prime(1-2q_d\prime)$
D	$b+\epsilon(1-2q_d), c+\epsilon\prime(1-2q_c\prime)$	$a+\epsilon(1-2q_d), a+\epsilon\prime(1-2q_d\prime)$

- $q_i \leq \frac{c-b}{2\epsilon}$: always co-operate
- $q_i \geq \frac{d-a}{2\epsilon}$: always defect

PAYOFFS EXPECTED

- Payoff expected for co-operating
  $\pi_c = b_i * (d + \epsilon(1 - 2 * q_c)) + (1 - b_i) * (c + \epsilon(1 - 2 * q_c))$
- Payoff expected for defected
  $\pi_d = b_i * (b + \epsilon(1 - 2 * q_d)) + (1 - b_i) * (a + \epsilon(1 - 2 * q_d))$
- Agent plays co-operate if $\pi_c \geq \pi_d$ and defect otherwise

GAME SIMULATIONS

- b_i is initialized keeping in mind the dynamics of the religions involved
- q_c, q_d is set keeping in mind the doctrines of the religion
- ϵ is set keeping in mind the intensity of reward/punishment aspect of religion

GAME SIMULATIONS: PARAMETER VALUES

We consider the dynamics between two religions: Hinduism, Islam. Parameter values for these and their justification is as follows:

- $b_H = 0.3$
- $b_I = 0.5$
- $\epsilon_H = 5$
- $\epsilon_I = 7$

- Muslims consider Hindus to be more cooperative than the reverse.
- Utility shock of Islam is higher relative to Hinduism.

GAME SIMULATIONS: GRAPH

α is set to 0.02

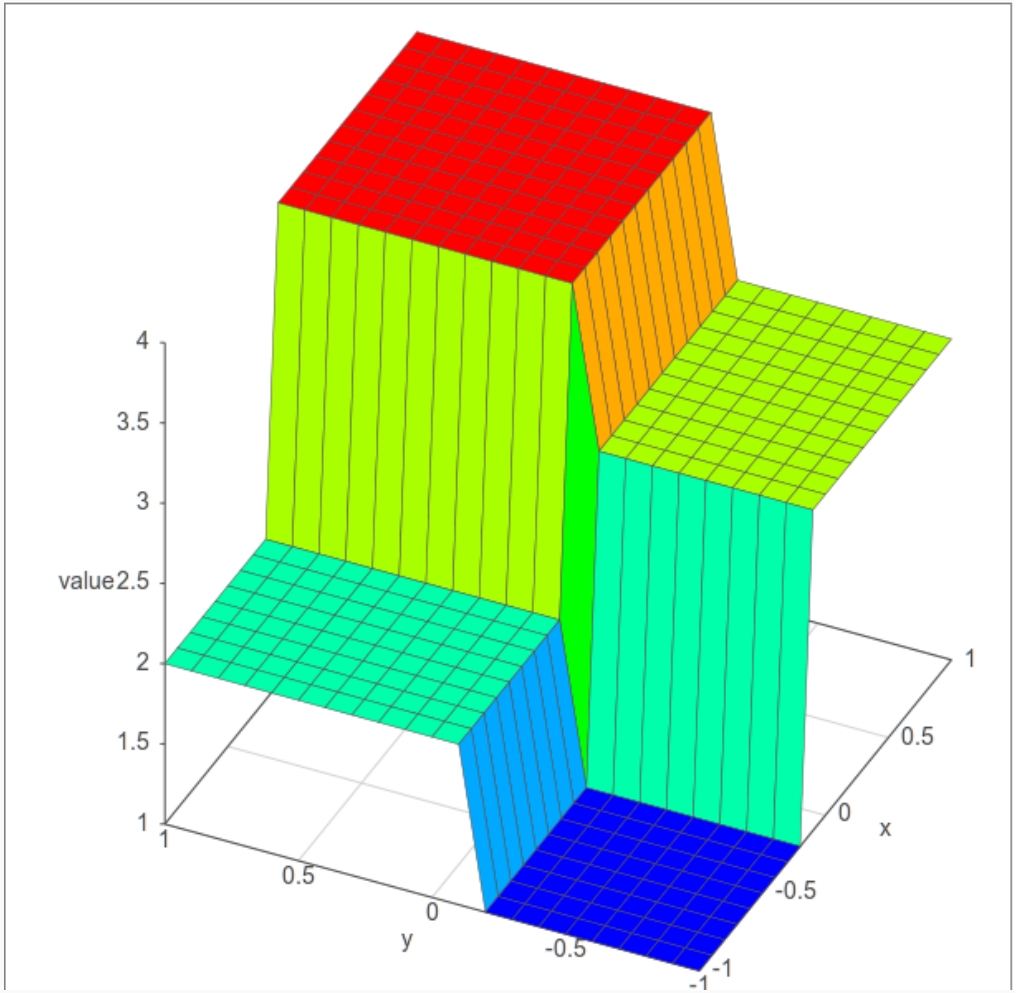

Figure: Graph showing the dependence of strategy on q_c and q_d

GAME SIMULATIONS: DISCUSSION

$q_i = q_c - q_d$

- High negative $q_i \rightarrow$ tendency to co-operate increases
  Belief that co-operation is highly rewarded and defection is penalized
- High positive $q_i \rightarrow$ tendency to defect increases
  Belief that co-operation is penalized and defection is rewarded
- On increasing $\epsilon \rightarrow$ tendency to co-operate increases with lesser negative value of q_i

GRAPH-BASED MODEL

- Every node is a religious agent.
- Number of nodes correspond to the geographic population of the religion they represent.
- An edge occurs between 2 religious agents if they are neighbours geographically and also if they seem to show interactions in the real world.

GRAPH-BASED MODEL

- Every agent plays against the nearest k neighbours of the opposite religion. Hence, pay-off for an agent is the sum of pay-offs received in each of these individual interactions.
- The strategy used by an agent remains same across all the players he plays.
- An agent updates his strategy by looking at how successful his peers have been in adopting an alternative strategy.

UTTAR PRADESH RELIGION CENSUS 2011

- Considered 9 districts in Uttar Pradesh and the percentage of Hindu and Muslim population in each.

District	Node ratio (Hindu: Muslim)
Baghpat	7:3
Meerut	6:4
Muzzafarnagar	6:4
Ghaziabad	7:3
Aligarh	8:2
Mathura	9:1
Agra	9:1
Rampur	5:5
Bareilly	6:4

ANALYSIS

- Every region was represented by 10 religious agents with (Hindus : Muslims) ratio accounting for the population of these two religions in that region.
- Interaction between different religious agents is not explicitly available to us via any data. Hence, to complete this information we made logical assumptions.
- We measure the harmony of a region by measuring the inverse count of the number of Defect – Defect links in that region.

RESULTS

The following results were obtained for the data considered.

- Amongst the neighbouring districts - Baghpat, Meerut, Muzzafarnagar and Gaziabad, we detected Muzzafarnagar to be the least harmonious disctrict (with a high frequency). This in some sense models the scenario in the real world.

Thank you!