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	Subject: Mathematics for AI & ML
	Bayesian Games:
`	•
	so far we have assumed, that each player
	knows the exact of other players. However
	so far we have assumed that each player knows the exact payoff of other players. However this assumption might not hold tone in
,	several scenarios.
	for Eg: In an auction, with the several
	bidders, each biddle might not know the
	valuation & therefore, the payoffs to the other
	players.
	, ,
	In several head life scenarios, there is
	Players, such games are known as
	players, such games are known as
	Bayesian Games.
	limple Bayesian Game Example!-
	Bayesian Version of Bos (Beittle of Sexes):
	BOS is a game in which Player 1 (Boy) and
	Player 2 (Girly can either choose B (Bach show) or S (stravinsky show).
	or S(stravinsky show).
	Now we are going to slightly modify the scenario where boy is uncertain about the mood of the gist. (Payoff)
	scenario where boy is uncertain about the
	mood of the gist.
	(Payoth)



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for enstan	ce ,
the	girl can be either interested or
not interest	girl can be either interested or en information to B or S.
so there ar	ayer P2, (Types Circl) Types
of girl pla	ager P2,
supresented	by I and U Types
1	<u> </u>
80 10 1001	cockerine it has not like told as
So we crus	lacterize it by probability. Lets eay
it is give	n thau
D(T) =	1/2 (Prob of girl interested)
0(11) 5	1/2 (Prob. uninterested)
P(0) -	
the Mair o	Yalaaloo la alab madiina in a Maat
there is	xample, we are assuming that
0.12 2 0.8	only one TYPE of player 1 (Ber
	B S
	3 10,5 10,0
TU }	
150	5,0,0 5,10
	<u>"</u>
Tank n	
	ichora a solution and a solution and a
tecor pr	
This is g	ame table for conventional Bos
mis is g	refers watching Bors with the game table for conventional Bos
rnis is g	jame table for conventional BOS



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	Game table for anint	exested girl can be
	modelled as	girl nout to
	crist	avail bar
	B S	girl want to avoid boy
		Game table
	B 10, 0, 0, 10	E correspondy to
	S 0,5 0,0	girl of type U.
*	hirl prefers to watch Bors a	
2	By prefers to watch Bors and	gether.
		110, girl get payoff of 0
	because she pre	fers not to watch B with
	boy.	
	·	
	Because the girl	is doing things differently
	(B,5) from the boy, t	ne girl gets a payoff of 10
	& boy gets o.	
	1000 - Boy's payoff is o	because boy watching s
	(9,B) but girl watching	s, girl prefers to watch
	something diffe	rent (but she is watching
	B which prefers	s. Girl prefex to watching rent (but she is watching less), so girl payoff is s
	(S,S) - Because Boy wat	thing S with girl, so (cause Boy prefers Bach). to watch anything boy, so her payoff is
	his payoff is 5	- (cause Boy prefers Bach)
	Corl prefers not	to watch anything
	together with	boy so her payors in
	zero.	



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	Subject	
	Bayesion Bos Game Table: - gist	C:
	B S	
	CB 10,5 0,0 SB 10,0. 0,10	<u> </u>
Bot	3 0,0 5,10 80,5 5,0	Ç
		C
	girl wish to girl wish to watch together avoid (watch alone)	Ç
	watch together avoid (watch alone)	Ç
	$P(v) = \frac{1}{2}$	
	$P(I) = \frac{1}{2}$	
*	The most important thing to remember an	
	bayeslam game is to assign a straiteg	4
	The most important thing to remember in bayesian game is to assign a strateg to each player goreach type.	(
	so, lets vonsider→	
	Boy choosing > B	
	Girl of type I choon; > B	
	U B	
	This can be represented as.	
	(B,B)	
	Strategy or action of strategy of action of	
	Strategy or action of Strategy of action of girl of type U	
	V	



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Now we want to compute the payoff of Boy corresponding to (B,B) stoategy of Girl.
choosey B Type I
e, we have to compute average payoff of Boy, average wirit. probabilities of type of giolo player
Ub(B,(B,B)) = P(I) * Ub(B,B).+ P(U) * Ub(B,B)
$= \frac{1}{2} * 10 + = 10$ $\frac{1}{2} * 10$
$U_{b_{\rho}}(S, (B,B)) = P(T) + U_{b}(S,B) + P(U) + U_{b}(S,B)$ = $\frac{1}{2} + 0 + \frac{1}{2} + 0 = 0$
$U_{b} (B,(B,S)) = P(I) * U_{b}(B,B) + P(U) * U_{b}(B,S)$ $= \frac{1}{2} * 10 + \frac{1}{2} * 0$ $= 5$
$U_b(S, (B,S)) = \frac{1}{2} * 0 + \frac{1}{2} * S = 2.5$ $U_b(B, (S,B)) = \frac{1}{2} * 0 + \frac{1}{2} * 10 = 5$ $U_b(S, (S,B)) = \frac{1}{2} * 5 + \frac{1}{2} * 0 = 2.5$



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	$u_b(B_1(S_1S)) = \frac{1}{2} + 0 + \frac{1}{2} + 0 = 0$	
	46(S,(S,S)) = = = + 5 + = 5	
	So, Average payoff table for Boy:	
		(
	(B,B) (B,S) (S,B) (S,S) B 10 5 5 0 B 2.5 2.5 5	(
6	S B 10 S S O 2.5 2.5 S	
	1 (() () () () () () () () ()	
		(
	To figure out the payoff of the girl of each type >	
	type >	
	for type (I) -> Standard table	C
	18.5 Here, we have	C
	B 10,5 0,0 illustrated the best	C
	B S there, we have illustrated the best s 0,0 s,10 response of the	
	girl of each	
	O C Languetti	
	for type(0) -) B 10,0 010 1 50 1t.	
	5 0,5 50	
	find the Bayesian Narh Equilibrium of Game >	
X	find the Bayesian Narh Equilibrium of Game >	
	(B,B) (B,S) (S,B) (S,S)	
	B 10 5 0 Best responses	
	5 0 2.5 2.5 S Boy	Children to .
	5.	AND DESCRIPTION



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- L Response for Boy.	M

Consider (B1B) in Boy table; bus subject: Mathematics for All ML lets theck B, (B,B) is BNE? If Boy choosing B, then Best Response of Gir (I) is B. CAN(U) is S. SU, B, B, B) NOT BNE Now consider (B,S) in Boy Table: Best Response is lets cheek if (B,(B,S)) is BNE? J boy choosing B, BROJ girl of type I is B

J Boy choosing B, BROJ girl of type V is S. so (C, H) is the BR of girl of each type for B of Boy. Therefore player2 (girl of each type) is playing her best Response. 80, (B,(B,S)) is BNE. (B, (B, S)) br of girl of B 21 BR of Br of girl of Boy to (B,S) type I to B of Doy



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*	Now consider (s, b) in Boy table - Best Response
	check (B,(S,B)) is BNE or not?
	If boy choosing B, BR of girl of Type I is - B Type V is - S
	girl of Type I is not playing to Best Response of Boy (B), same with girl of Type U.
	So (B(S,B)) is not BNF.
*	Now consider (8,8) is boy table - BR is S.
	check (s,(s,s)) is BNE?
	If Boy choosing S, BR of girl of type I = S type U = B
	So Here girl of type V is not playing to Best Respon
	so (S,(S,S)) is not BNF.