Algorithmic game theory

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Regret minimization

Example

Example

No Regret Learning

(review)

No single action significantly outperforms the dynamic.


	1	0
	0	1

Weather					Profit
Algorithm					3
Umbrella					3
Sunscreen					1

Source: No regret algorithms in games (Georgios Piliouras)

Polynomial weights algorithm

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Algorithm 0.4: POLYNOMIAL WEIGHTS ALGORITHM(X, T, η)

Input : A set of actions $X = \{1, \ldots, N\}$, $T \in \mathbb{N}$, and $\eta \in (0, 1/2]$.
Output : A probability distribution p^t for every time step t.
$w_i^1 \leftarrow 1$ for every $i \in X$,
$p^1 \leftarrow (1/N, \ldots, 1/N)$,
for $t = 2, \ldots, T$

do
$w_i^t \leftarrow w_i^{t-1}(1 - \eta \ell_i^{t-1})$,
$W^t \leftarrow \sum_{i \in X} w_i^t$,
$p_i^t \leftarrow w_i^t / W^t$ for every $i \in X$.

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Algorithm 0.8: NO-REGRET DYNAMICS(G, T, ε)

Input : A game $G = (P, A, C)$ of n players, $T \in \mathbb{N}$ and $\varepsilon > 0$.
Output : A prob. distribution p_i^t on A_i for each $i \in P$ and step t.
for every step $t = 1, \ldots, T$

do
- Each player $i \in P$ independently chooses a mixed strategy p_i^t using an algorithm with average regret at most ε.
- Each player $i \in P$ receives a loss vector $\ell_i^t = (\ell_i^t(a_i))_{a_i \in A_i}$, where $\ell_i^t(a_i) \leftarrow \mathbb{E}_{a_{-i}^t \sim \prod_{j \neq i} p_j^t}[C_i(a_i; a_{-i}^t)]$.

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Source: https://img.etimg.com

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Thank you for your attention.