Non-Monotone DR-submodular Maximization over general convex sets

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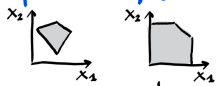
Maximize F over K

Properties of domain $K \subseteq [0,1]^n$

(continuous domain rather than $\{0,1\}^n$)



Possible applications
price optimization
maximizing profit in a demand forcasting model
[NeurIPS 2016]

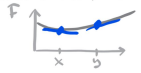
Properties of function $F: K \to \mathbb{R}$

- non necessarily monotone
- diminishing return submodular

For all x, y, with $\forall i: x_i \geq y_i$; and $z = (0, \dots, 0, \varepsilon, 0, \dots, 0)$, $\varepsilon > 0$ we have $F(x+z) - F(x) \leq F(y+z) - F(y)$

- smooth

$\exists$ constant β s.t. $\forall x, y$: $\|\nabla F(x) - \nabla F(y)\| \leq \beta \|x - y\|$



Our Theoretical Contribution

Hard Problem
we aim for approximation guarantees

OFFLINE ALGORITHM PRODUCING x is an (α, β)-approximation if $F(x) \geq \alpha F(x^*) - \beta$
(approximation ratio, convergence rate)

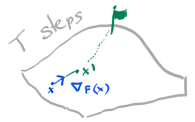
K \ F	DR-submodular	general
unconstrained $K = [0,1]^n$		$(\frac{1}{2}, 0)$ [2,3]
down-closed convex	$(\frac{1}{e}, O(\frac{1}{T}))$ [1]	
convex	$\left(\frac{1 - \min_{x \in K} \|x\|_\infty}{3\sqrt{3}}, O(\frac{1}{\sqrt{T}})\right)$	

most previous work is for monotone functions

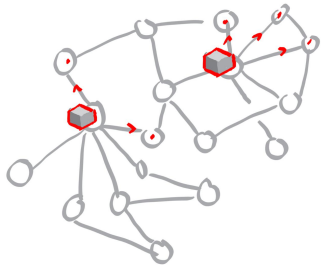
[1] BIAN, LEVY, KRAUSE, BUHMANN NIPS '2017
[2] BIAN, BUHMANN, KRAUSE, NIPS '2018
[3] MAZADEH, ROUGHGARDEN, WANG, NIPS 2018

METHOD USE FRANK-WOLF ALGORITHM WHICH IS BASED ON GRADIENT ASCENT

CONTRIBUTION ANALYZE PERFORMANCE IN THIS GENERAL FRAMEWORK

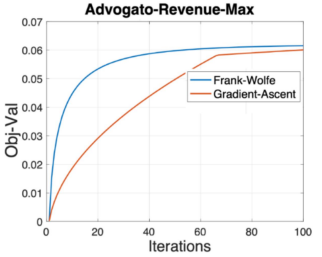


Experiments



Problem:
Find set of good seeds for rumor spreading

We observe good performance



THANK YOU