A discrimination-based Civil Violence Model

Complex Social Systems: Modeling Agents, Learning, and Games

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30th November 2020

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Goals

- Implement the agent-based computational model of civil violence described by Epstein [Eps02].

"All the News That's Fit to Print"

The New York Times

National Edition
Partly to mostly sunny. Highs in middle 60s to middle 70s. Clear to partly cloudy tonight. Lows in upper 40s to 50s. Thunderstorms north tomorrow. Weather map is on Page 24.

VOL. CLXIX .... No. 58,710 SUNDAY, MAY 31, 2020 Printed in Chicago $6.00

LEADERS CALL FOR CALM AS UNREST SPREADS


Source [Tim20]

President Needles as America Burns

By PETER BAKER

WASHINGTON — With a nation on edge, ravaged by disease, hammered by economic collapse, divided over lockdowns and even face masks and now convulsed once again by race, President Trump's first instinct is to look for someone to fight.

NEWS ANALYSIS

Over the last week, America reeled from 100,000 pandemic deaths, 40 million people out of work and cities in flames over a brutal police killing of a subdued black man. But Mr. Trump was on the attack against China, the World Health Organization, Big Tech, former President Barack Obama, a cable television host and the mayor of a riot-torn city.

While other presidents seek to cool the situation in tinderbox moments like this, Mr. Trump plays with matches. He roars

Fearing Chaos Could Spin Out of Control

This article is by ***John Eligon, Matt Furber*** *and* ***Campbell Robertson.***

MINNEAPOLIS — The nation woke on Saturday to extraordinary images of chaos and unrest from outside the White House gates to the streets of more than two dozen besieged cities, as outrage over the death of George Floyd in Minneapolis traversed a razor's edge between protest and civic meltdown.

As state and local leaders braced for more protests over the weekend in cities around the country, they both called for calm and vowed to react strongly to protesters who defied the law.

The Pentagon ordered the Army to prepare active-duty military police units to deploy to Minneapolis as protests engulfed that city for a fourth night on Friday, with businesses set on fire and gunshots fired near a police

Goals

- Implement the agent-based computational model of civil violence described by Epstein [Eps02]. In particular a central authorit
- Take inspiration from the social movement Black Lives Matter by introducing some modifications to the standard model.

The agent based model presented by Epstein

Generalised Rebellion Against Central Authority

This model involves to categories of actors:

- **Agents** are members of the general population and may be actively rebellious (so-called "active") or not (so-called "quiet").
- **Cops** are the forces of the central authority, who arrest actively rebellious agents.

The Agents Specification

- Political grievance $\mathbf{G}$
- Agents level of risk aversion $\mathbf{R} \rightarrow$ How much inclined is the agent to take risks?
- Estimated arrest probability $\mathbf{P}$
  - Agent's vision $\mathbf{v} \rightarrow$ number of position that the agent is able to inspect, i.e. "how far he can see".
  - $(\mathbf{C/A})_{\mathbf{v}}$ is the cop-to-active ratio within vision $\mathbf{v}$.

Define the agent's net risk as $\mathbf{N} = \mathbf{RP}$.

The Agents Specification

If, for a quiet agent, the difference $G - N$ exceeds some non-negative threshold **T**, then that agent goes active. Otherwise, he stays quiescent.

Agent rule A: If $G - N > T$ be active: otherwise, be quiet.

The Cop Specification

- Cop vision $\mathbf{v}^*$

Cop rule C: Inspects all sites within $\mathbf{v}^*$ and arrest a random active agent.

RUN

Movement rule M: Move to a random site within your vision.

RUN

1. Set the initial values, the maximum jail term $\mathbf{J_{max}}$ and the initial cop and agent densities.
2. Cops and (initially) quiescent agents are situated in random positions.
3. The model spins forward under the rule set: {**A**, **C**, **M**}.

Two-kind agent model

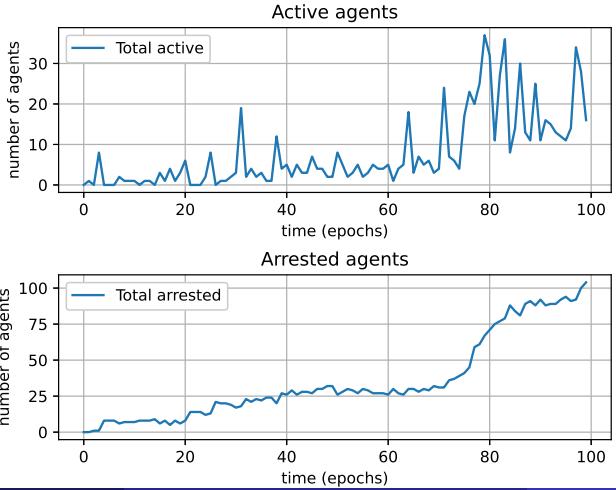
Modifications for a two-kind agent model

- Two different types of agents: type 0 and type 1.
- Discrimination factor **D** $\rightarrow$ measures how much type 1 is discriminated by taking the ratio

$$\frac{\#\text{ type 1 arrested}}{\#\text{ total arrested}}$$

New Agent rule: If $G - N + D > T$ be active: otherwise, be quiet.

Active & Arrested agents, typical simulation



What causes peaks of active agents?

In our model peaks of active agents are mainly due to two factors:

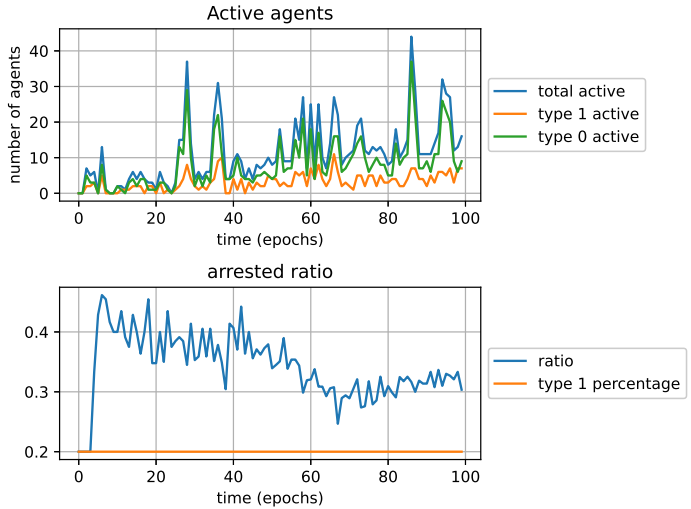
- random configuration of the nation (agents concentrated in an area with no cops)
- peaks in the discrimination (measured as the ratio between arrested agents of type 1 and total arrested agents)

Peaks of Discrimination

We tried to understand how the ratio between arrested agents of type 1 and total arrested agents evolves in the model. The main points are the following:

- By the nature of the model, peaks of discrimination cause peaks in active agent, but we can have peaks in active agents without peaks in ratio.
- By the nature of the model, peaks of active agents cause peaks of discrimination (two-ways relation)
- Empirically we notice that the model does not allow for "large" peaks in discrimination.

Active Agents and Discrimination



Can we induce large peaks of discrimination?

We tried to break the equilibrium of the model by inducing artificially peaks of discrimination in the two following ways:

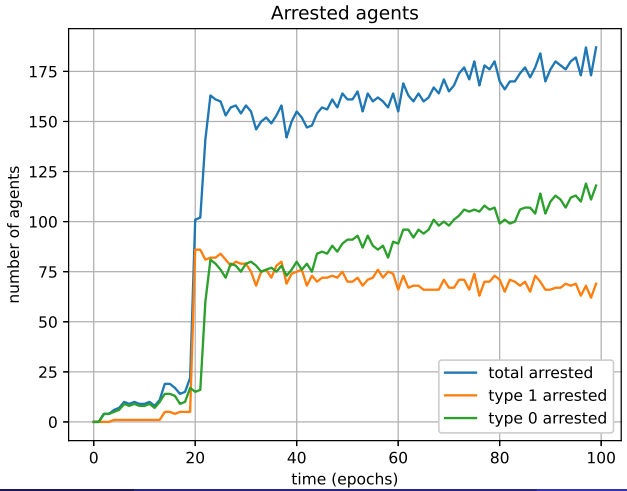
i Scenario 1: At time $t_0 = 20$ arrest 80 type 1 agent (independently on their status).

ii Scenario 2: From time $t_0 = 10$ to $t_1 = 20$ arrest 10 type 1 agent (independently on their status) at each turn.

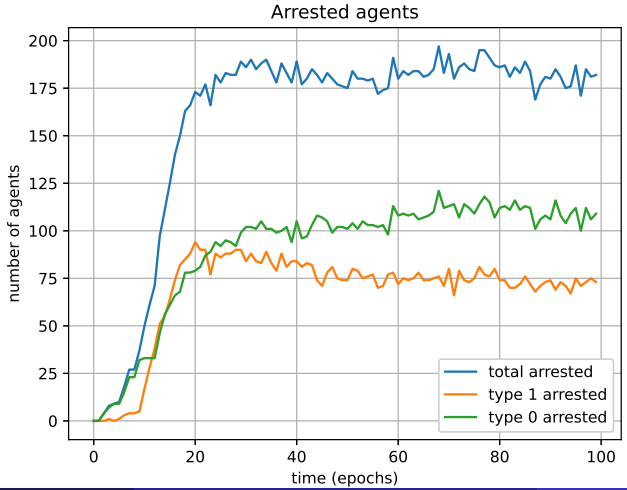
Scenario 1, Active Agents and Discrimination

Scenario 2, Active Agents and Discrimination

Scenario 1, Arrested Agents



Scenario 2, Arrested Agents



Discrimination does stir up rebels

Introduction

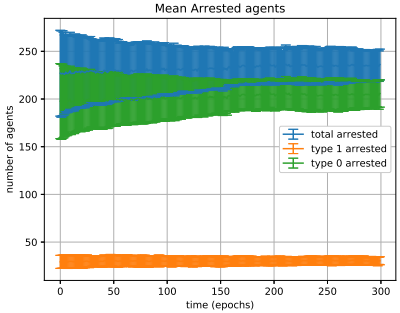
- Does discrimination actually modify the model?
- Comparison of rebellious behaviour with and without discrimination
- Realistic demographical values for agents distribution and discrimination

Type 1	agent are 20% of the total
Cops	arrest a type 1 agent with 35% probability
Jail time	is 50% longer for type 1 agents

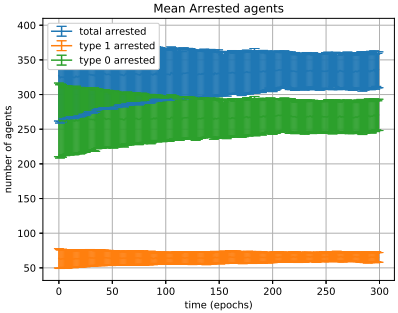
Simulation details 300 time steps and 30 runs

Discrimination does stir up rebels

Comparison Arrests



(a) No discrimination



(b) Discrimination

Figure: Arrests

Extreme discrimination stabilises the nation

A borderline example

- We assume now that the $\mathbf{J}_{\max}$ is considerably lower: $\mathbf{J}_{\max} = 5$

  Motivation: Time inconsistency of the agents or actual government decision

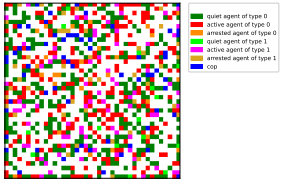
Motivating example:

Type 1 agent are 20% of the total

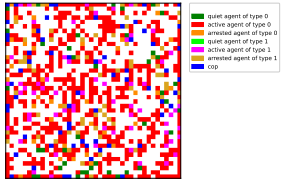
Cops arrest a type 1 agent with 60% probability

First Scenario Jail time is equal for all agents

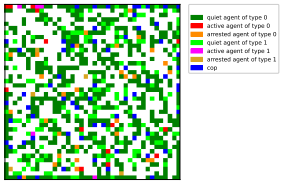
Second Scenario Jail time is now 5 times longer for type 1 agents



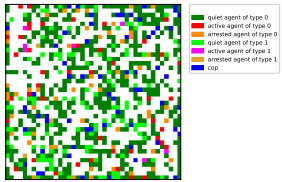
(a) No Discrimination, 5th Day



(b) No Discrimination, 15th Day



(c) Discrimination, 5th Day



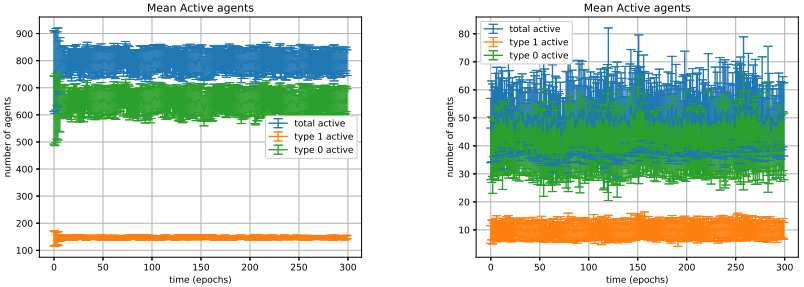
(d) Discrimination, 15th Day

Figure: Arrests

Government discrimination stabilises the nation

Realistic considerations

- Such a behaviour is observed also for less discriminating cops but same discriminating government



(a) Same jail time

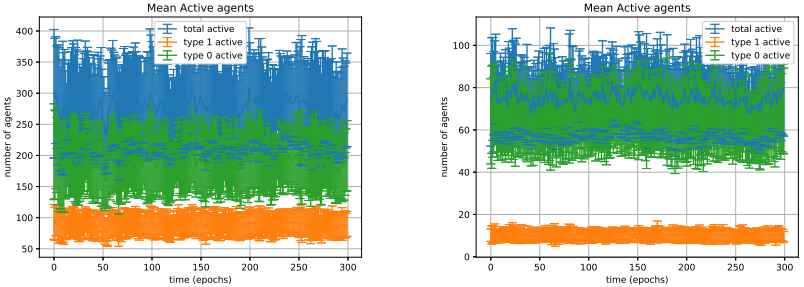
(b) 5 times more jail for Type 1

Figure: Active Agents borderline example

Government discrimination stabilises the nation

Realistic considerations

- Such a behaviour is observed also for less discriminating cops but same discriminating government



(a) Same jail time

(b) 5 times more jail for Type 1

Figure: Active Agents realistic example

Government discrimination stabilises the nation

Observations and remarks

- An effective method for repressing rebels is a government discrimination (increased jail time) of the minority
- This works well for models with highly and moderately discriminating cops; but effectiveness increases with the increase of cop discrimination

Locally discrimination-sensitive agents are less rebellious

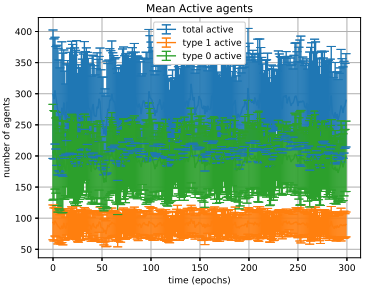
Up to now agents were able to "feel" the discrimination of the whole nation (e.g. presence of social media, news channels etc)

Now investigate what happens if only local (within the agent's vision) discrimination is "felt"

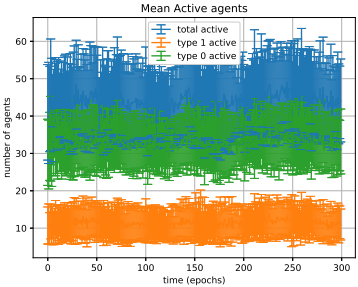
We keep all other parameters unaltered

Locally discrimination-sensitive agents are less rebellious

Non-discriminating government



(a) Global discrimination-vision

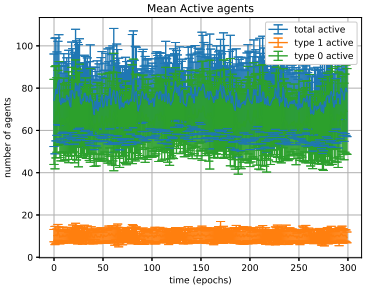


(b) Local discrimination-vision

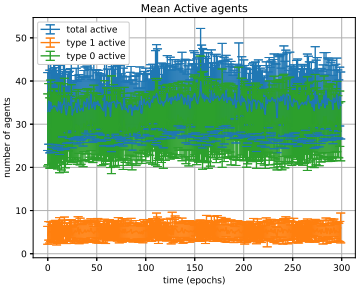
Figure: Active Agents for non-discriminating government

Locally discrimination-sensitive agents are less rebellious

Discriminating government



(a) Global discrimination-vision



(b) Local discrimination-vision

Figure: Active Agents for Discriminating government

Bad-cop agent model

Motivation

- For BLM the legitimacy is about the police
- The original model bases the legitimacy on a global variable
- If the police itself defines the legitimacy, we can take the violence into the model
- Simulate the change of legitimacy following violent police behaviour

Model

- Two kind of cops: violent and non-violent
- Legitimacy is now a local variable for each agent
- Behaviour of cops is locally perceived by agents and changes the legitimacy of each nearby agent

Cops

- Similar behaviour as in the original model
- They get an aggressiveness value, which is used for the change in legitimacy
- Violent cops have a high positive aggressiveness value
- Good cops have small negative aggressiveness value

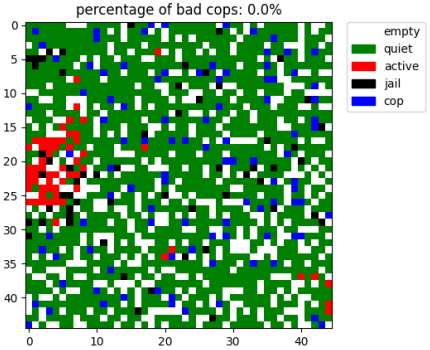
Behaviour

We use the Illegitimacy instead of the Legitimacy

$$Il = 1 - L$$

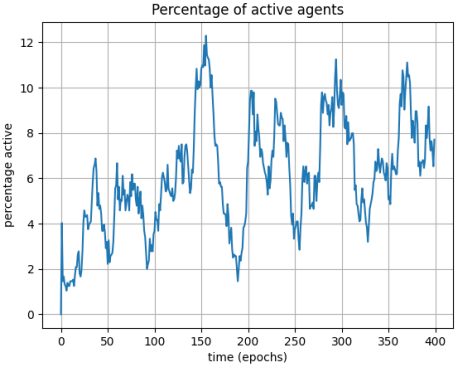
$$Il(n) = Il(n-1) * \exp(A * \sum \text{aggressiveness value of nearby cops})$$

Lack of police officers - 0% of bad cops



A lack of police officers leads to an uprising on the left

Epsteins Model - 0% of bad cops



We can see periodic peaks regarding active agents

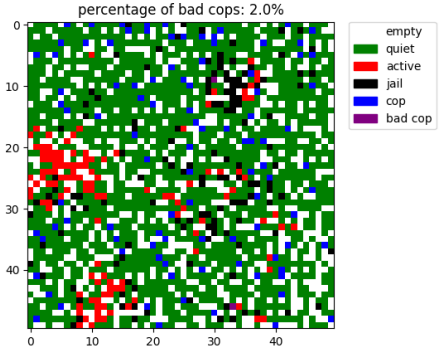
How does a typical simulation look like?

- Nation dimension 50 x 50
- Total number of agent 1750
- Total number of cops 100
- Vision 4
- Violent cops have an aggressiveness value of 1
- Good cops have an aggressiveness value of -0.12

Analysing behaviour of bad cops

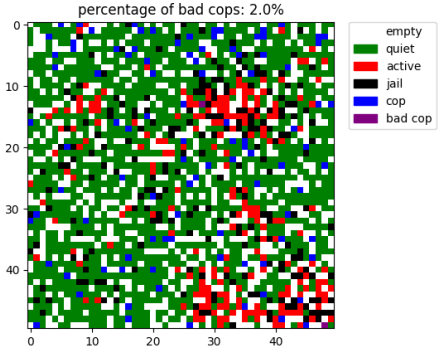
- Check whether a higher number of cops calm the agents or make them more active
- Can we compensate the effect of bad cops by adding more cops?

2% of bad cops - 100 Cops



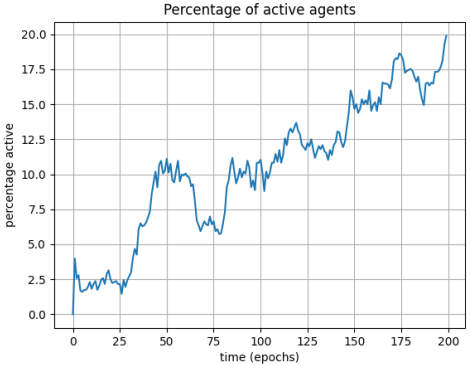
In absence of cops random clusters start developing

2% of bad cops - 100 Cops



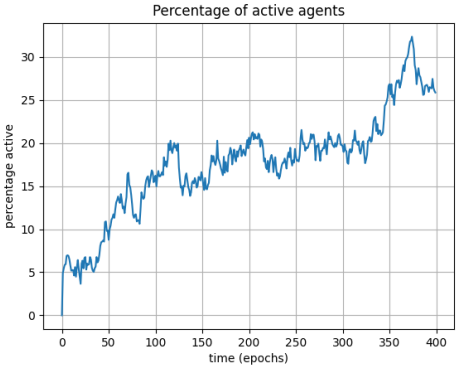
Clusters move, focus around bad cops

2% of bad cops - 100 Cops



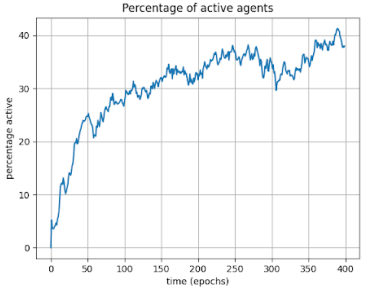
Amount of active agents is slowly raising

2% of bad cops - 100 Cops

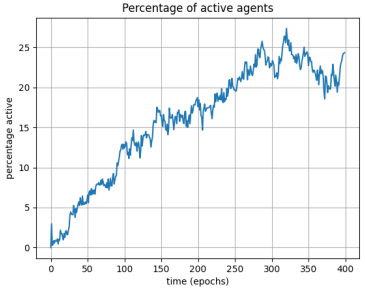


Until it becomes more stable

5% of bad cops - 100 / 200 cops



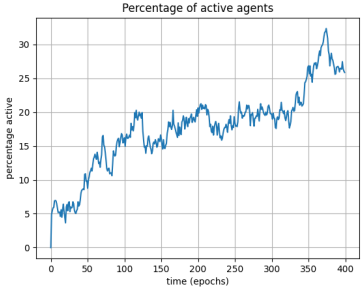
(a) 100 Cops



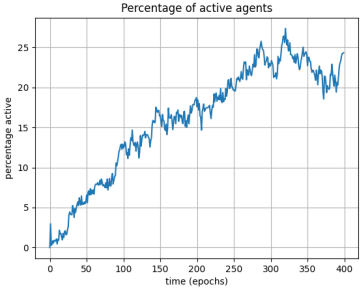
(b) 200 Cops

Active agents

5% / 200 cops - 2% / 100 cops



(c) 100 Cops



(d) 200 Cops

Active agents

Analysing behaviour of bad cops

- The influence of a bad cop spreads way further than the vision range of the bad cop
- We can compensate for bad cops by adding a lot more cops. This can result in a police state

Summing up

- Discrimination has some inertia and the model does not allow rapid changes in its value.
- Discrimination substantially increases civil rebellion
- The easiest way to avoid rebellion is to decrease the number of bad cops. But if we can't, adding way more cops also solves the problem.

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[Eps02] Joshua M. Epstein. 'Modeling civil violence: An agent-based computational approach'. In: *Proceedings of the National Academy of Sciences* 99.suppl 3 (2002), pp. 7243–7250. ISSN: 0027-8424. DOI: 10.1073/pnas.092080199. eprint: https://www.pnas.org/content/99/suppl_3/7243.full.pdf. URL: https://www.pnas.org/content/99/suppl_3/7243.

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