Natural Selection summary

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Artificial Intelligence &
Information Analysis Lab

Natural Selection

- **Introduction to Natural Selection**
- Simulation of a Natural Selection in a Society
- Rules of the Society
- Simulation results

Introduction to Natural Selection

Natural selection definition:

The process whereby organisms better adapted to their environment tend to survive and produce more offspring.

The theory of its action was first fully expounded by charles darwin, and it is now regarded as the main process that brings about evolution.

Introduction to Natural Selection

In its essence, natural selection is simply about rates of reproduction and mortality:

Those individual organisms who happen to be best suited to an environment survive and reproduce most successfully, producing many similarly well-adapted descendants.

After numerous such breeding cycles, the better-adapted dominate.

Nature has filtered out poorly suited individuals and the population has evolved.

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Natural Selection Simulation

Natural Selection will be simulated.

The simulation will take place in a society with special rules.

The society and its members will be simpler than what a real-life environment is.

In real life, there are external factors that may affect society.

Netlogo

The project will be written and executed using NetLogo.

NetLogo is a multi-agent programmable modeling environment.

It is used by many hundreds of thousands of students, teachers, and researchers worldwide.

NetLogo can be used to teach programming, computational thinking, simulation and model building, and understanding of complex phenomena through models in many different domains.

It is authored by Uri Wilensky and developed at the CCL.

Netlogo
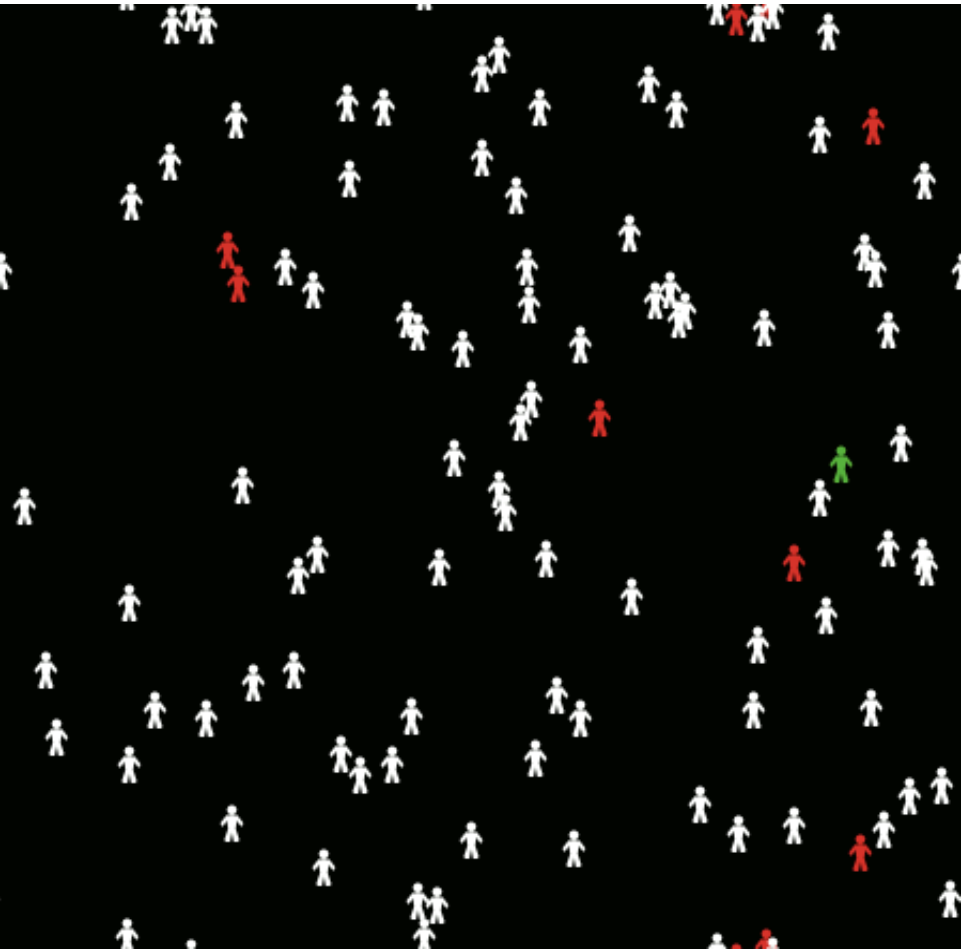
The colors represent:

- White : Not infected yet
- Red   : Infected
- Green : Cured

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Rules of the Society

The rules of the society are simple:

1. Each creature to survive the next day must eat a fruit.

2. If a creature eats two fruits then it lives and reproduces.

Reproduces means it replicates itself the next day.

The breed of creatures that manage to eat the most is the one most suitable for the environment.

Netlogo

	Doves	Hawks
Doves	Each Dove will take 1 fruit.	The Hawk will take 3/2 of the fruits and the Dove only 1/2 *
Hawks	The Dove take 1/2 of the fruit and the Hawk 3/2 **	The Hawks will fight, get injured and lose energy, hence they will get 0 fruit each.

* Eating 1/2 fruit means that the bird will have a 50% chance of surviving the next day.

** Eating 3/2 fruit means that the bird will survive and will have a 50% chance of reproducing.

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Netlogo

	Doves	Hawks
Doves	Each Dove will take 1 fruit.	The Hawk will take 3/2 of the fruits and the Dove only ½
Hawks	The Dove take 1/2 of the fruit and the Hawk 3/2	The Hawks will fight, get injured and lose energy, hence they will get 0 fruit each.

* The arrows are showing what strategy best serves the birds.

The cells that have inward arrows are stable states, whereas the cells with outgoing arrows are unstable states.

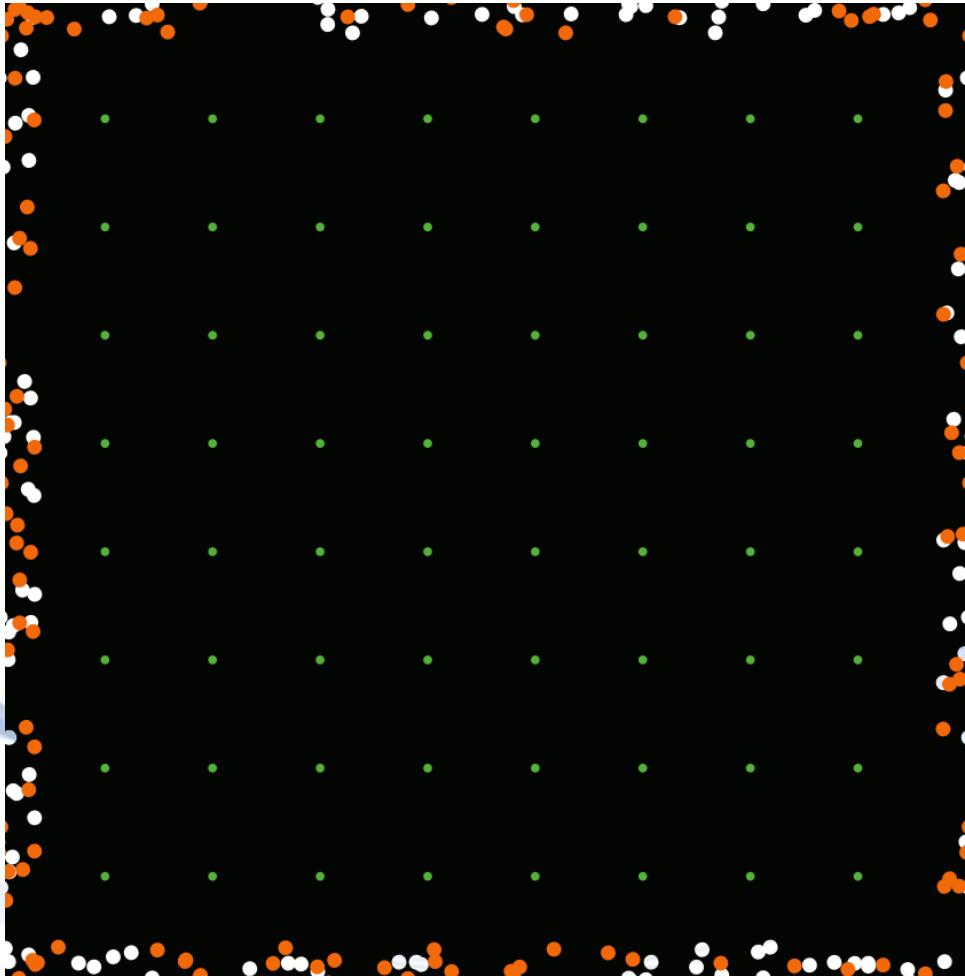Artificial Intelligence & Information Analysis Lab

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- **Simulation results**

Simulated Society

In the simulation it will be seen if the expected results happen.

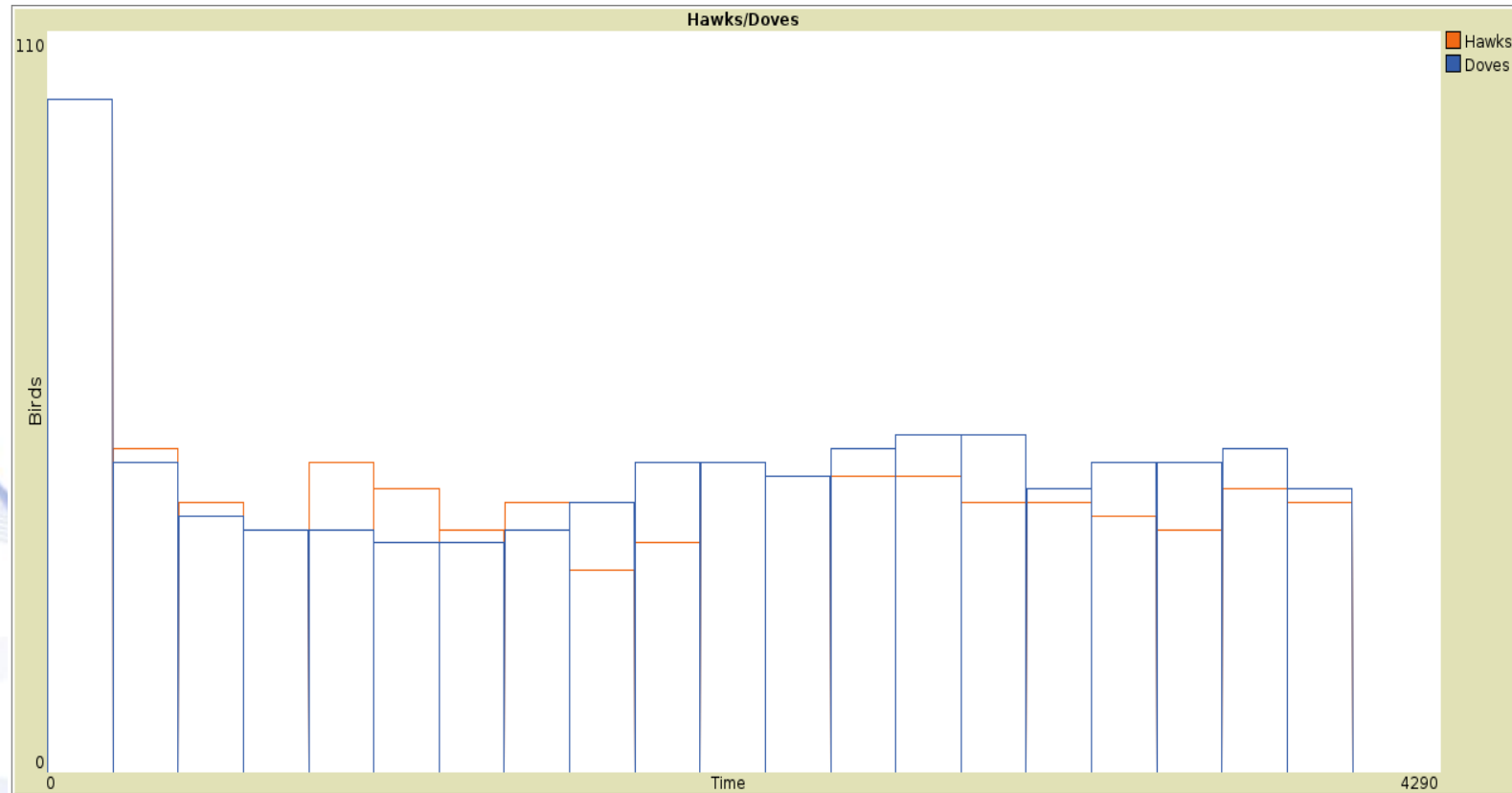In the following slide, the first "day" of the simulation is shown.

Netlogo

The colors represent:

- White   : Doves
- Orange : Hawks
- Green   : Fruits

Simulated Society

This graph shows the population of each bird for the first 20 days.

On the first day, 100 of each bird exist.

The lack of fruit decreases the population.

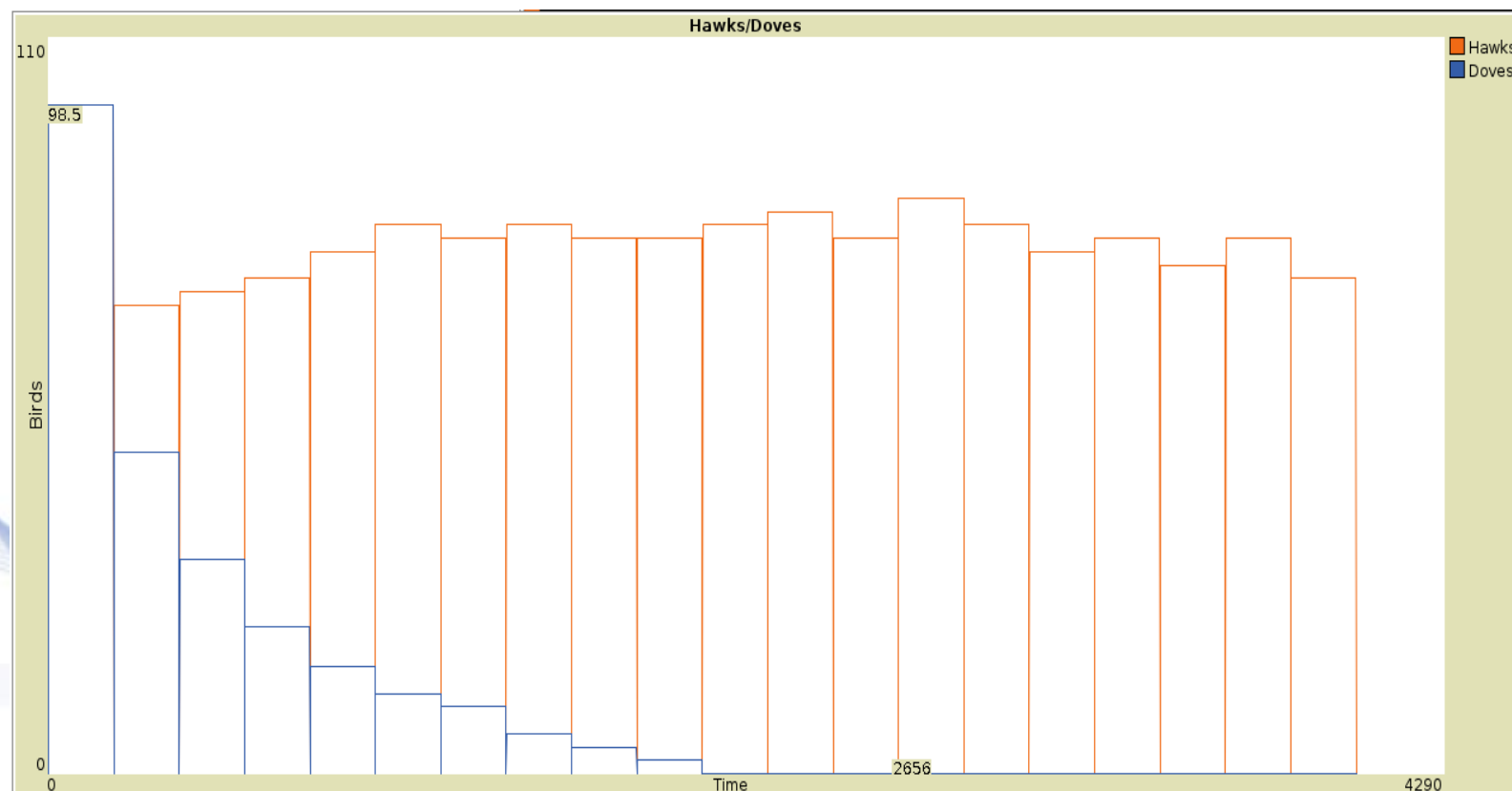Doves and Hawks tend to have the same population.

Simulated Society

In the histogram above, when hawks share, all the fruit is lost.

The results as expected show that the population of Doves and Hawks tend to be the same.

In the following slide, when hawks share, each will take ¾ of the fruit.

Simulated Society

On the first day, 100 of each bird exist.

The lack of fruit decreases the population.

Doves go extinct and many Hawks live.

Simulated Society

The results as expected show that the population of Doves goes down until no Doves are left.

Even though the optimal strategy for the Birds was for all of them to be doves, only Hawks survive.

It can be observed that Natural Selection doesn't always result in the best solution.

Q & A

Thank you very much for your attention

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