TIS– MIDDLE PRESENTATION

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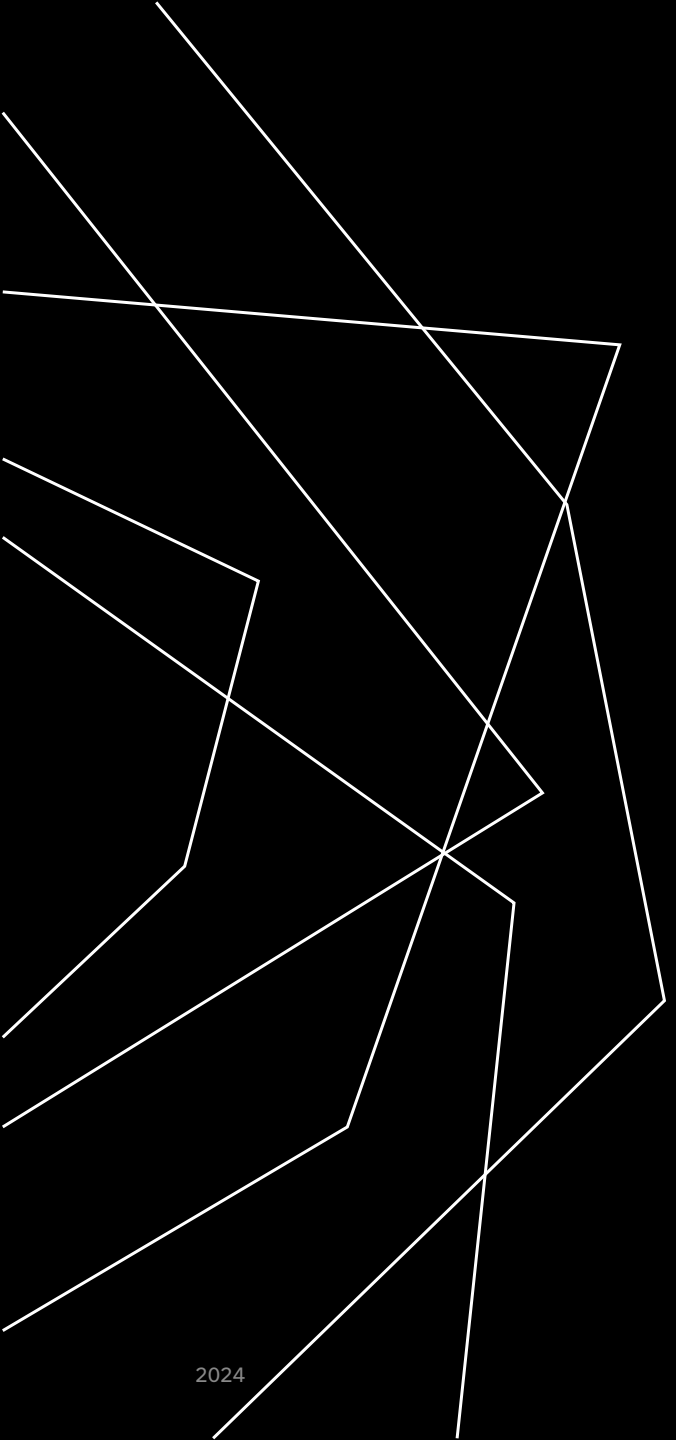

LEARNING FAIRNESS IN MULTI-AGENT SYSTEMS

MOTIVATION

In the same way fairness is crucial for a working society, the authors of the selected article argue that improving fairness in a Multi-Agent System can enhance its performance.

As most of today's methods focus primarily on maximizing individual or shared rewards without incorporating fairness, systems can become inefficient or even unstable.

FAIR-EFFICIENT NETWORK (FEN)

To overcome this balancing problem between fairness and efficiency, the authors propose their Fair-Efficient Network. This model introduces a hierarchical structure where a controller selects sub-policies to optimize the system's performance. The controller’s main task will then be to maximize the “fair-efficient reward”, by learning which sub-policy to select at each time, while the sub-policies learn to coexist.

FAIR-EFFICIENT REWARD

The article defines a fair-efficient reward for each agent that balances two key components:

- **Efficiency**: Measured as resource utilization, encouraging agents to optimize their use of shared resources.
- **Fairness**: Quantified by the coefficient of variation (CV) in agents' utilities, penalizing agents whose rewards deviate significantly from the average. This reward enables each agent to learn a policy that considers both their own and others' behaviors, promoting a more balanced distribution of resources.

WORK PLAN

REFERENCE WORK ANALYSIS

Alongside the paradigm’s description, the article provides us with three experiments where its ideas are put into practice: job scheduling, the Matthew Effect and a manufacturing plant.

So it will be our starting point to analyze the code to see how the fair-efficient reward is applied and extract the more important features.

EFFICIENCY/FAIRNESS BALANCE

With the three experiments properly studied and replicated, the next step will be to start manipulating the fair-efficient reward formula to visualize the effects that come from each change.

Starting with a system that mainly focuses on efficiency, the fairness weight will be increased bit by bit in order to see how the agents' behavior changes as their perception of a need for balanced resource distribution grows stronger.

FORMULA MANIPULATION

After analyzing the fairness/efficiency balance, our next step will be to perform the necessary modifications on the original formula in order to obtain the most out of this paradigm.

To conclude if such modifications do in fact exist, it will only be possible after the planned analyses are performed.

RESULTS COMPARISON

If we do in fact conclude that there are possible improvements to be performed, our final step will be to compare the results from our version to the article's one.

Regardless, a comparison between the different fairness/efficiency balances will be performed to analyze the main divergences.