

The background of the slide is a black canvas filled with a dense, chaotic network of thin, light-colored lines. These lines are populated with small, multi-colored dots in shades of pink, purple, yellow, and green, representing the particles in a swarm optimization algorithm. On the right side, there is a large, white, vertically-oriented shape with a pointed top and a pointed bottom, resembling a stylized arrow or a drop. This shape contains the title and student information. The title 'PARTICLE SWARM OPTIMIZATION' is centered within this white shape in a large, black, serif font. Below the title, the word 'STUDENTS:' is centered in a smaller, black, serif font. Underneath, there is a bulleted list of two students, each with their name and a number in parentheses, also in a black, serif font. The entire slide is framed by a thin, dotted white line that follows the outer edge of the white shape and extends slightly beyond it.

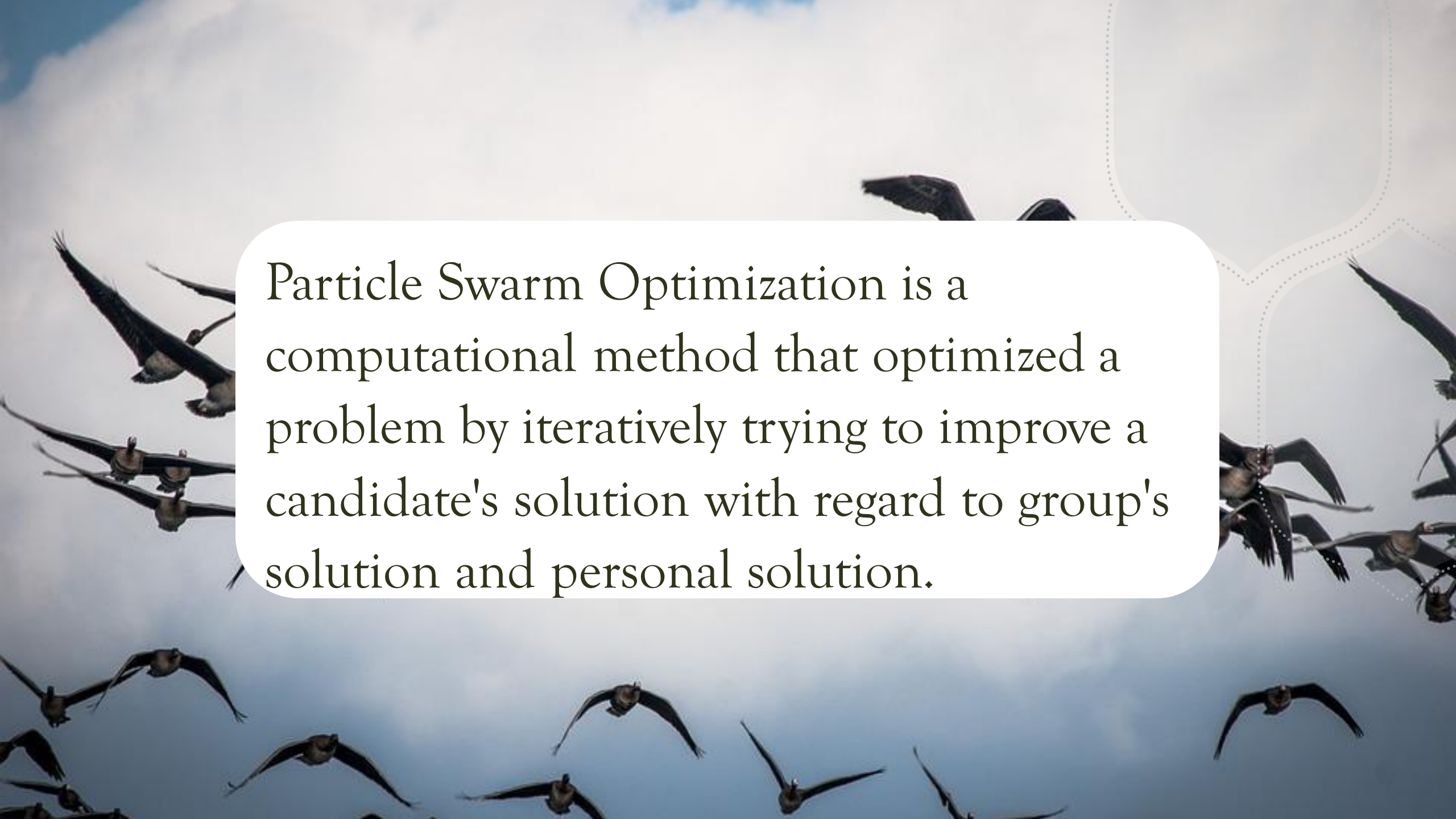
PARTICLE SWARM OPTIMIZATION

STUDENTS:

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(351)

WHAT IS PARTICLE SWARM OPTIMIZATION?



A flock of birds, possibly terns, is shown in flight against a blue sky with scattered white clouds. The birds are silhouetted against the sky, with some showing white underparts. They are flying in various directions, creating a sense of movement. In the center of the image, there is a white, rounded rectangular text box containing the following text:

Particle Swarm Optimization is a computational method that optimized a problem by iteratively trying to improve a candidate's solution with regard to group's solution and personal solution.

THE INSPIRATION BEHIND THE ALGORITHM



The algorithm is inspired by nature.



It mimics the behavior of the birds in nature, when they are looking for food.



The location of the food is unknown.



A bird uses its best position, but also the group's best, and by merging the two it will update its position to be closer to the food.

PROBLEM STATEMENT

- Training an ensemble of weak models is beneficial for generalization, so we wanted to extend this concept by training models with unequal voting rights.
- We wanted to overcome the difficulties associated with vanishing gradient and exploding gradient.
- We tried to adapt feed-forward neural networks to perform well on tabular data.

For all that, we tried to use the Particle Swarm Optimization algorithm in hope for good results.

OUR APPROACH

- Trained Ensemble of Models for Classification
- Trained Ensemble of Models for Regression
- Trained Using PSO a MLP
- Trained Using PSO a RNN



RESULTS

- The training of the ensemble of classification models did not exceed the unweighted ensemble or the best model.
- The training of the ensemble of regression models has made some small improvements in performance for models with almost equal results.
- We were able to solve the exploding gradient problem and the vanishing gradient problem for a small version of a Vanilla RNN.
- We have a slightly better performance for the PSO trained MLP than the gradient-based trained MLP.

FUTURE IMPROVEMENTS

- ♦ Parametric-efficient method
- ♦ Training neural networks architectures that are intended for tabular data
- ♦ Training bigger architectures for recurrent neural networks.
- ♦ Combining gradient-based training with PSO training.



CONCLUSIONS

We 've come to the conclusion that the Particle Swarm Optimization algorithm is not suitable for the ensemble of models for classification, due to the nature of the algorithm.

The results on training neural networks with this algorithm gives hopes for future improvement.

