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Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (Tshcdhso): Isvhaai AI Society Letters

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Abstract

Vhaai In Isvhaai stands for Very Highly Advanced Artificial Intelligence. VHAAI is a field used by International Society for VHAAI (ISVHAAI) for solving problems. This is the Letter No. 14 of ISVHAAI Artificial Intelligence Society Letters. In this Letter, a new algorithm titled Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (TSHCDHSO) is designed.

Keywords: Artificial Intelligence, AI, VHAAI, ISVHAAI, Centralized Control in Swarm intelligence, Decentralized, Teacher, Student, Human Swarm Optimization, HSO, TSHCDHSO

Introduction

Articles [1] to [5] show that Swarm Intelligence is an active area of research [1-5]. A novel algorithm titled Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (TSHCDHSO) has been designed in this article. Section 2 and Section 3 shows designed TSHCDHSO algorithm and Conclusions made respectively. References are available at the end.

Teacher Student Hyrbid Centralized Decentralized Human Swarm Optimization

Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (TSHCDHSO) algorithm is explained in this Section. In line no.1 Population of Centralized Students is initialized. These Centralized Students are instructed by Teacher and behaves as instructed and are controlled by Teacher. If Teacher instructs Centralized Student to move towards Best Student then this Student will follow the instruction. Population of Decentralized Students is initialized in line no. 2. These Decentralized Students are not under the central control and move like normal swarm. Generation is set to 0 in line no. 3. In line no. 4 Movement_Magnitude_Array of all Students is initialized. In lines 5 to 8 Best, Middle and Worst Students are identified. Loop for each Student is started in line no. 9. The code for Centralized Students begins at line no. 10 and ends at line no. 32. Lines 33 to 36 shows the code for Decentralized Students. The Teacher instructs and controls Centralized Students. The probability that the Teacher Instructs Centralized Student to move towards Best Student is 0.25 as shown in line no. 11. Similarly, the probability that Teacher instructs Centralized Student to move away from Middle Student is 0.25 as shown in line no. 12. There are two more probabilities as shown in lines 13 and 14. Hence the movement of Centralized Students are controlled by Teacher. The Centralized Student can either move towards Best Student, away from Middle Student, towards Middle student and away from the Worst Student as instructed and controlled by Teacher. On the other hand, Decentralized Students are like normal Swarm and there is no Centralized Control. As shown in lines 33 to 36, the Decentralized Student always moves towards the Best Student.

Procedure

Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (TSHCDHSO)

- Initialize Population of Centralized Students. These Students are under the Centralized control of Teacher.
- Initialize Population of Decentralized Students. These Students are not under the control and behave like normal Swarm.
- Generation = 0
- Initialize Movement_Magnitude_Array of all Students

• Calculate fitness values of all Students
• Student_Best = Student with Best fitness value
• Student_Middle = Student with Middle fitness value
• Student_Worst = Student with Worst fitness value
• For each Student:
• If Centralized Student:
• Probability_Teacher_Instructs_Towards_Best = 0.25
• Probability_Teacher_Instructs_Away_Middle = 0.25
• Probability_Teacher_Instructs_Towards_Middle = 0.25
• Probability_Teacher_Instructs_Away_Worst = 0.25
• 15) Generate Random Number TI
• Based on TI and Probabilities the following are Movement_Direction and Position Update Equations:
• If Probability_Teacher_Instructs_Towards_Best then:
• Movement_Direction = Student_Best - Student
• Convert Movement_Direction into Unit Vector
• Location = Location + Movement_Direction*Movement_Magnitude_Array [Student]*Step
• Else If Probability_Teacher_Instructs_Away_Middle then:
• Movement_Direction = Student – Student_Middle
• Convert Movement_Direction into Unit Vector
• Location = Location + Movement_Direction*Movement_Magnitude_Array [Student]*Step
• Else If Probability_Teacher_Instructs_Towards_Middle then:
• Movement_Direction = Student_Middle - Student
• Convert Movement_Direction into Unit Vector
• Location = Location + Movement_Direction*Movement_Magnitude_Array [Student]*Step
• Else If Probability_Teacher_Instructs_Away_Worst then:
• Movement_Direction = Student – Student_Worst
• Convert Movement_Direction into Unit Vector
• Location = Location + Movement_Direction*Movement_Magnitude_Array[Student]*Step
• Else If Decentralized Student:
• Movement_Direction = Student_Best - Student
• Convert Movement_Direction into Unit Vector
• Location= Location + Movement_Direction*Movement_Magnitude_Array[Student]*Step
• End For each Student Loop
• Generation = Generation + 1
• Continue this process until termination condition is reached

Conclusions

Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (TSHCDHSO) is the unique algorithm designed in this letter. Teacher controls the movement of Centralized Students in search space. Four movements are shown in this article for Centralized Students. There is scope to explore different and more number of movements in the search space with different probabilities. Decentralized Students are not under Centralized control. One movement is shown in this article for Decentralized students. One may explore different kind of movements. This is just the beginning of Teacher Student Hybrid Centralized Decentralized Human Swarm Optimization (TSHCDHSO) algorithms. One may design novel and unique algorithms moving in the direction shown in this article.

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