MIDRANGE EXPLORATION EXPLOITATION SEARCHING PARTICLE SWARM OPTIMIZATION WITH HSV-TEMPLATE MATCHING FOR CROWDED ENVIRONMENT OBJECT TRACKING

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We hereby declare that We have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy.

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ABSTRAK

Particle Swarm Optimization (PSO) telah menunjukkan keberkesanannya dalam menyelesaikan masalah pengoptimuman. Namun begitu, algoritma PSO masih mempunyai kekurangan dalam mencari penyelesaian yang optimum. Ini disebabkan oleh kekurangan penerokaan dan eksploitasi zarah di seluruh ruang carian. Masalah ini juga boleh menyebabkan penumpuan pramatang, ketidakupayaan untuk membebaskan diri dari terperangkap pada optima tempatan, dan mempunyai kekurangan dalam peningkatan prestasi bagi setiap zarah. Oleh itu, varian baharu PSO yang dikenali sebagai Midrange Exploration Exploitation Searching Particle Swarm Optimization (MEESPSO) telah dicadangkan untuk mengatasi kelemahan ini. Di dalam algoritma ini, setiap zarah yang mempunyai nilai paling corot akan berpindah ke kedudukan baharu untuk memastikan konsep penerokaan dan eksploitasi kekal dalam ruang carian. Ini adalah cara untuk mengelakkan zarah daripada terperangkap dalam optima tempatan dan mengeksploitasi dalam penyelesaian suboptimum. Konsep penerokaan akan diteruskan apabila zarah diperbaharui pada kedudukan baharu. Seterusnya, untuk menilai prestasi MEESPSO, kami menjalankan eksperimen pada 12 fungsi penanda aras. Manakala untuk persekitaran dinamik, kaedah baru MEESPSO dengan padanan templat dan nilai Hue, Saturation, Value (HSV) telah dicadangkan untuk meningkatkan ketepatan dan kejituan pengesanan objek dalam persekitaran yang sesak. Berdasarkan 12 fungsi penanda aras, hasil menunjukkan peningkatan prestasi yang lebih baik dalam penumpuan zarah, konsisten dan ralat berbanding dengan algoritma lain. Manakala, ujikaji untuk penjejakan objek telah dijalankan pada set data PETS09 dan MOT20 yang mempunyai persekitaran yang sesak dengan beberapa cabaran seperti tindanan objek, penampilan objek yang serupa dan perubahan bentuk objek yang ketara. Keputusan menunjukkan bahawa prestasi kaedah pengesanan yang dicadangkan telah meningkat lebih daripada 4.67% dan 15% dalam ketepatan dan kejituan berbanding dengan kerja-kerja lain yang dilaporkan.

ABSTRACT

Particle Swarm Optimization (PSO) has demonstrated its effectiveness in solving the optimization problems. Nevertheless, the PSO algorithm still has the limitation in finding the optimum solution. This is due to the lack of exploration and exploitation of the particle throughout the search space. This problem may also cause the premature convergence, the inability to escape the local optima, and has a lack of self-adaptation in their performance. Therefore, a new variant of PSO called Midrange Exploration Exploitation Searching Particle Swarm Optimization (MEESPSO) was proposed to overcome these drawbacks. In this algorithm, the worst particle will be relocating to a new position to ensure the concept of exploration and exploitation remains in the search space. This is the way to avoid the particles from being trapped in local optima and exploit in a suboptimal solution. The concept of exploration will continue when the particle is relocated to a new position. In addition, to evaluate the performance of MEESPSO, we conducted the experiment on 12 benchmark functions. Meanwhile, for the dynamic environment, the method of MEESPSO with Hue, Saturation, Value (HSV)-template matching was proposed to improve the accuracy and precision of object tracking. Based on 12 benchmarks functions, the result shows a slightly better performance in term of convergence, consistency and error rate compared to another algorithm. The experiment for object tracking was conducted in the PETS09 and MOT20 datasets in a crowded environment with occlusion, similar appearance, and deformation challanges. The result demonstrated that the tracking performance of the proposed method was increased by more than 4.67% and 15% in accuracy and precision compared to other reported works.

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