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Squiride Rank:
Squirrel Ride Rank Algorithm-Based Feature Extraction for Re-Ranking of Web Pages

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ABSTRACT

Web page ranking is the one of the key components in search engine. Ranking aims to offer ranked list of web documents that are relevant to the user query. Even though, various re-ranking algorithms are developed, providing prompt responses to the user query result a major challenge in the dynamic web environment. Therefore, an efficient and effective ranking algorithm named Squirrel Ride Rank (SquiRide Rank) algorithm is developed to re-rank the web documents in the search engine. The proposed SquiRide Rank algorithm is designed by integrating the Squirrel Search Algorithm (SSA) with the Rider Optimization Algorithm (ROA), respectively. The concept of fictional computing and the foraging behavior realize the re-ranking process more effectively in the web environment. The features extracted from the web pages makes the process more effective and achieve global optimal solution through the fitness measure. The proposed SquiRide Rank algorithm effectively captures and analyzes the ranking scores of different search engines in order to generate the re-ranked score result. However, the proposed SquiRide Rank algorithm provides satisfactory results using the metrics, like precision, recall, and F-measure, which acquired with the values of 0.964, 0.996, and 0.980, respectively.

KEYWORDS

Rider Optimization Algorithm (ROA), Search Engine, Squirrel Search Algorithm (SSO), Web Mining, Web Page Re-Ranking

1. INTRODUCTION

Image inpainting is the reconstruction process of lost or worse portion in images and videos (Ruikar & Ghuge, 2016; Ghuge, *et al.,* 2018). The image inpainting is an antique art which requires the human artists to perform the work by hand. Nowadays, investigators or researchers have developed many techniques for automatic inpainting. Besides to the image, many techniques also need a mask as input for representing the regions in an image. The image inpainting operation acts as an important research area, and the results from these research areas can be applied to cultural relic's protection, text removal, television and film effect, and in several other specific aspects (Wu & Ruan, 2006). Image inpainting methods are extensively used in the applications of image restoration, object removal, image

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compressing and various other applications. The aim of reconstructing the injured or the misplaced parts of the images (Jegatheeswari & Deepa, 2019) with the use of the incomplete data that are observed as accurate as possible is termed as image inpainting (Mo & Zhou, 2018). The applications, such as suppresment of the scratches and texts in the ancient drawings, removal of the undesirable area of a film or photograph, restoration of the missed pixel at the time of image transmission (Zheng, *et al.,* 2018) make in use of the concept of image inpainting. The usage of the self-similarity inherent of the images by the image inpainting algorithms helps in the synthesis of the missing data. In addition, the inpainting processing strategy helps in the reduction of noise, demosaicing, and super resolution, and so on (Guo, *et al.,* 2018). The inpainted portion is merged into the image in such a way, which cannot be identified by a viewer (Fadili, *et al.,* 2009). The Image inpainting method has been utilized in image restoration, image compression, object removal, and so on (Fan & Zhang, 2018). Now a day, it has been used in visual effect production, image rectification, image compression, and so on (Jin & Bai, 2018). In addition, image inpainting can be applied to repair the damaged photos, complete the missing regions, image deblurring, and so on (Karaca & Tunga, 2018).

The image inpainting methods are classified into a texture synthesis method and partial differential equation method (Wu & Ruan, 2006). The image-level features are used by conventional inpainting techniques to resolve the problem of hole filling. The Patch-Match (Guo, *et al.,* 2018) is a method used in finding the best matching patches for the reconstruction of the missing area. However, these methods can be used only for low-level features and thus cannot be applied for the high-level features. In addition, they propagate the image from outside to the hole, instead of obtaining the global image structure, which is unwanted by a human (Song, *et al.,* 2018). Two types of image inpainting methods are (i) image editing in undesired or text object removal and (ii) the image restoration in blob and scratch removal from the old image. These methods are further divided into two types, namely exemplar-based techniques for texture synthesis and diffusion-based techniques for structure propagation. In the case of the diffusion-based methods (Bertalmio, *et al.,* 2000–Bornemann & März, 2007), the data is proliferated smoothly from its borderline. These techniques utilize the partial differential equation (PDE) for the propagation of the linear structures in the isophote direction. The PDE based techniques are capable of producing a thin target region, like scratch covered with the smooth region. At the same time, in the case of texture images, these methods make a blurring effect with the presence of smoothing terms (Ghorai, *et al.,* 2018).

The image inpainting methods are grouped based on edges (Bertalmio, *et al.,* 2003), exemplars (Aujol, *et al.,* 2010), sparsity, statistics (Bertalmio, *et al.,* 2000), and geometry (Bertalmio, *et al.,* 2001) methods. The Markov random field's model, curvature-driven diffusions model, total variation models, local inpainting, and bounded variation image model are the models of images commonly used in image inpainting. In addition, various intelligence-based methods are used in image inpainting. As a commonly used classification and regression tool, SVM is successful in bioinformatics, image processing (Vinusha, 2019)., and various other fields. An SVM model is computed firstly for image inpainting. The SVM model is used in image inpainting, but the estimation of the parameters of SVM is highly complicated (Kaijie, *et al.,* 2017). Deep neural networks (DNN) are exploited for several machine learning tasks (Kanhar and Chandak, 2020), like supervised image classification (Yu, *et al.,* 2018). The conventional DNN can be used due to the fact that it has been built with important prior knowledge about natural image statistics, which is highly useful in image inpainting (Fawzi, *et al.,* 2016). K-NN is another approach used in image inpainting, which produces better estimates about the unknown pixels. The improved form of K-NN uses the subspace mapping functions, which are learned using the linear regression. The linear regression is usually used in the estimation of the unknown pixels (Guillemot, *et al.,* 2013). Metaheuristic algorithms (Dey, 2017, Nilanjan, et al., 2020, Gangappa, et al., 2019, Malar, et al., 2020, and Menaga, et al., 2018) plays a major role in image inpainting.

This paper develops an automatic image inpainting method with a newly developed optimization algorithm. The steps involved in the proposed image inpainting technique are Patch extraction and mapping, Image reconstruction, and Fusion. Initially, the input images are given to the patch extraction