

Candidature Post-Doc

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Nouvelle édition MOBIDOC : Vers l'Excellence



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Expérience professionnelle (s'il y en a) :

Enseignant universitaire contractuel et vacataire (5 années),
Co-encadrement des mémoires de niveau mastère de recherche,
Plusieurs stages de recherche et développement au sein des établissements universitaires et industriels,
Participation à plusieurs formations et à l'organisation d'événements scientifiques,
Plusieurs compétences en informatique,
Productions scientifiques,

Informations à propos du diplôme de doctorat et des travaux de recherche et innovation (R&I) envisagés

Etablissement universitaire d'obtention du doctorat : *

ENIT (Ecole Nationale d'Ingénieurs de Tunis)

Structure de recherche du doctorat : *

Laboratoire de recherche LATIS (Laboratory of Advanced Technology and Intelligent Systems) de l'université de Sousse, Tunisie + Laboratoire de recherche L3i (Laboratoire Informatique, Image et Interaction) de l'université de la Rochelle, France

Discipline à laquelle appartient le diplôme de doctorat : *

STIC (Sciences et Technologies de l'Information et de la Communication)

Année d'obtention : *

2017

Intitulé de la thèse : *

CONTRIBUTIONS TO INDEXING AND SEARCHING IN DOCUMENT IMAGE DATABASES

Bref descriptif de la thèse : *

With the rapid increase in the availability of document image datasets, there is a growing need for effective and efficient document querying methods. This thesis deals with the problem of Content-based Document Image Retrieval (CBDIR) on large document image databases. In this thesis, we propose a new content based document query approach that is capable to retrieve document images based on weighted visual and structural similarities for both full document image and focused based retrieval scenarios.

The proposed approach starts by representing document images and queries by Fuzzy Attributed Relational Graphs (FARGs). FARG nodes represent document image regions and FARG edges represent spatial relationships between regions. Both the nodes and the edges are represented with their fuzzy attributes. The use of fuzzy graph-based description (instead of a classic graph-based representation which is a rigid description) could be helpful to add flexibility against eventual segmentation errors which may be occurred after the segmentation of document regions. Moreover, representing the document image content by fuzzy graphs allows to capture the maximum information from a document image with a certain error-tolerance. A FARG database containing all the obtained FARGs is constructed.

Afterwards, the document retrieval problem is transferred to how to match two FARGs. Therefore, we propose a tree search based inexact sub-FARG matching algorithm with new similarity functions in order to measure how well a query FARG matches a target FARG. A query can be either in the form of a set of Regions Of Interest (ROIs) from a document image or an example of full document image or a sketch. Regions and its relationships in the specified queries are supposed to be provided by the user with different relative importance levels. Fuzzy attributes used in their descriptions can be also weighted according to their level of importance. Therefore, the retrieval results will be more closer to the users' expectations. Experiments on two synthetic databases and one real database containing a high number of FARGs with large sizes proved the scalability and effectiveness of the proposed inexact sub-FARG matching algorithm in terms of accuracy and time processing.

In the context of dealing with a large mass of document image datasets, it is not trivial to perform an exhaustive and sequential comparison of the query with all document images in the database due to the high computational complexity requirements. Thus, we propose a new approximate algorithm for the computation of the Fuzzy Generalized Median Graph (FGMG) based on a new FARG embedding in a suitable vector space in order to contribute to the structuration of the FARG space and to improve the accuracy and speed of document image retrieval processing. The proposed FGMG representation avoids the sequential search in a FARG database by direct access to a reduced set containing the FARGs most similar to a query FARG. The proposed algorithm proceeds in three main steps. The first step aims at mapping each FARG from graph space to a set of feature vectors into a suitable vector space. The second step consists in clustering the obtained vectors using a Fuzzy C-Means (FCM) classification. Then, a weight measure is associated to each cluster. Finally, the third

step in our approach is a step of converting the obtained clusters to a FGMG in the graph space. Experiments on real and synthetic databases containing a high number of FARGs with large sizes show that a CBDIR using the FGMG as a dataset representative yields better results than an exhaustive and sequential retrieval in terms of gains in accuracy and time processing.

In this thesis, we focus only on the application of the proposed inexact sub-FARG matching and FGMG computation algorithms to the CBDIR problem. The obtained results open the possibility of extending the application of these algorithms to other real applications such as pattern recognition, classification, image analysis, etc.

Keywords: Fuzzy Attributed Relational Graph; Tree search based inexact sub-FARG matching; Similarity measure; User interaction; Graph embedding; Fuzzy Generalized Median Graph; Document Image Retrieval.

Thème(s) de R&I envisagés dans le cadre du projet MOBIDOC : *

Dématérialisation des documents, Sciences et Technologies de l'Information et de la Communication, traitement d'images, informatique, ...

A quel(s) secteur(s) d'activité(s) pourrait éventuellement appartenir l'organisme bénéficiaire d'accueil visé ? *

Technologies de l'Information et de la Communication, entreprises de dématérialisation et traitement d'images, établissements industriels, établissements administratifs, établissements universitaires, structures de recherche, ...

Informations complémentaires (s'il y a lieu) :

Ces travaux de recherche ont permis de fournir différentes solutions aux entreprises de dématérialisation dont l'objectif est de mettre à la disposition de leurs clients une version numérique des documents papiers accompagnés d'informations qui leurs sont relatives et de répondre au besoin croissant de méthodes de recherche et d'indexation automatique de documents.

Les différentes approches proposées ont été expérimentées sur des bases réelles et synthétiques contenant un grand nombre de Graphes Relationnels Attribués Flous (GRAFs) de grandes tailles. Les résultats expérimentaux obtenus pour chacune de ces bases sont intéressants, encourageants et ouvrant des perspectives prometteuses à la fois pour la recherche (par exemple : étendre l'application des contributions proposées à d'autres applications réelles telles que la reconnaissance de formes, la classification, l'analyse d'images, etc.) et pour l'entreprise.

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