

ECE1786 Project Final Report



EZPaperSearch

Paper Recommendation Application

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word count = 1984
penalty = 0

Permission

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Permission to post video	Yes	Yes
Permission to post final Report	Yes	Yes
Permission to post source code	No	No

1 Introduction

Paper searching can be very time consuming and tiring, especially when looking for papers on a specific topic. The project aims to build an effective and efficient paper recommendation application, EZPaperSearch, that helps users find papers they might be interested in without having to spend hours reading through dozens of articles. The paper recommendation application takes in the title and abstract of the context paper from the user and outputs a list of related articles to the user as recommendations (Figure 1).

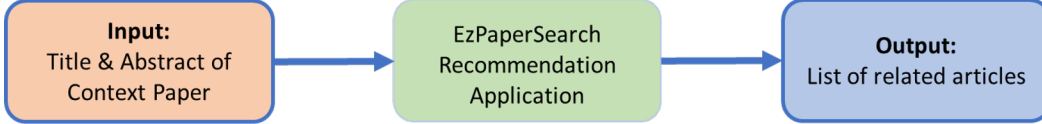


Figure 1: Input and Output of EZPaperSearch Application

2 Background and Related Work

To achieve the task, we will be measuring the similarity of papers. The most intuitive method to evaluate the similarity of two documents is comparing them word by word. Rada et al. [1] comprehensively evaluated various corpus-based or knowledge-based word semantic similarity measures, such as Pointwise Mutual Information [2], Latent Semantic Analysis [3], Leacock & Chodorow similarity [4] and Lesk similarity [5]. The best F1 score (81.3%) was achieved by combining several methods into one with simple average while the vector-based similarity baseline using TF-IDF weights achieved 75.3% F1 score. However, this method relies heavily on external resources: corpus and knowledge. In addition, it ignores the connection and semantics between words.

Recently, with the explosion of deep learning techniques, more and more researchers designed siamese deep learning networks in the semantic text match area. Jyun Yu et al. proposed a Siamese multi-depth attention-based hierarchical recurrent neural network (SMASH RNN [6]). SMASH RNN is designed to tackle the challenge of extracting the semantics of individual words, phrases and sentences from complex document structures. It incorporates two MASH RNNs and fuses the output using a siamese structure and is shown to be effective in measuring the semantic similarity between two long-form documents. Thus, the SMASH RNN model has the potential for application in related article recommendations where precise long-form semantics analysis is essential. Extensive research also shows that SMASH RNN is superior (82.19% accuracy) in related article recommendations compared to other methods such as regular RNN, CNN, and DeepQA.

Since 2018, the emergence of large pre-trained transformers has significantly change the natural language processing area. BERT [7], RoBERTa [8] and GPT2 [9] have been successfully applied in the task of semantic textual similarity, and achieved the state of art performance [10]. In 2019, Nils Reimers and Iryna Gurevych designed a Siamese BERT network: Sentence-BERT to derive meaningful text embeddings from the input [10]. This structure reduced a high computational overhead required by

a single pre-trained transformer network. Sentence-BERT achieved around 87.79% accuracy compared to single BERT network whose accuracy was 84.94% with SentEval toolkit [11].

3 Data Processing

The dataset used for this project is the open-source S2ORC dataset [12], which covers 136m+ scientific papers from 20 fields of study. This dataset is sufficiently large and contains all the necessary information required for training our model: the title, abstract, and references used in the papers as well as the field of study.

Considering the wide range and the huge amount of papers in our dataset, we decided to concentrate on papers in one field of study: Computer Science. We downloaded 1,795,148 paper entries and performed data cleaning and labeling to train our model.

3.1 Data Cleaning

- Load data from Json file and extract columns containing useful information: ‘id’, ‘title’, ‘paperAbstract’, ‘Out-Citations’, ‘fieldsOfStudy’.
- Remove data points with missing information.
- Remove non-English papers.

The cleaned dataset contains 224,394 paper entries.

3.2 Data Labeling

The models take inputs as pairs of papers (described in more detail in section 4.0). The following steps showed how we constructed our data samples and how we labeled them.

- Generate all possible unique paper pairs among all papers
- For each paper pair, calculate the similarity of citations using Jaccard similarity. The reference similarity is used as a metric for measuring the relatedness of papers in each paper pair [6]

$$Jaccard(U, V) = \frac{|U \cap V|}{|U \cup V|}$$

- Label positive samples whose similarity is greater than 0.5.
- Randomly select an equal number of pairs whose similarity is 0 as negative samples. Figure 2 shows two examples of positive paper pair and negative paper pair. The label of the data looks reasonable to us.
- Split the dataset into training, validation, and testing sets

1 entry

index	title1	abstract1	title2	abstract2	out_similarity
204	Excitation, observation, and ELF-MD: optimization criteria for high quality test sets	In previous work, we have shown that optimizing the number of site observations leads to more defect detection. However, for increasingly difficult defects, optimizing patterns for balanced random excitation also enhances test effectiveness. We can also reduce the effect of undetected defects by choosing tests that minimize the likelihood of field failures.	Balanced excitation and its effect on the fortuitous detection of dynamic defects	Dynamic defects are less likely to be fortuitously detected than static defects because they have more stringent detection requirements. We show that (in addition to more site observations) balanced excitation is essential for detection of these defects, and we present a metric for estimating this degree of balance. We also show that excitation balance correlates with the parameter ζ in the MPG-D defective part level model.	0.89

1 entry

index	title1	abstract1	title2	abstract2	out_similarity
18	Alternate hammering test for application-specific DRAMs and an industrial case study	This paper presents a novel memory test algorithm, named alternate hammering test, to detect the pairwise word-line hammering faults for application-specific DRAMs. Unlike previous hammering tests, which require excessively long test time, the alternate hammering test is designed scalable to industrial DRAM arrays by considering the array layout for potential fault sites and the highest DRAM-access frequency in real system applications. The effectiveness and efficiency of the proposed alternate hammering test are validated through the test application to an eDRAM macro embedded in a storage-application SoC.	Efficient 1064 nm conversion to the eye-safe region using an external cavity diamond Raman laser	We present a 1064 nm pumped diamond Raman laser operating with 71% quantum conversion efficiency to the 2nd Stokes wavelength of 1485 nm. Up to 1.6 W average power is produced with excellent beam quality.	0.0

Figure 2: Examples of paper pair

Table 1: Data splitting

	Training	Validation	Testing
Split Ratio	0.7	0.15	0.15
Sample Count	1160	248	248

4 Baseline model

The baseline model is a TFIDF-based model that measures document similarity by evaluating how relevant a word is to a document in a collection of documents. The model takes into consideration two factors: term frequency (TF) and inverse document frequency (IDF). The former measures how many times a word appears in a document, and a higher value means the higher importance of the word to this document. IDF evaluates how frequently a word appears in a set of documents. A word occurs frequently among all documents carries less information from a specific document, such as *'then'*, *'a'*. The final metric TFIDF is the multiply of TF and IDF [13]. In this sense, the model is well suited for the task of measuring the similarity between scientific papers. With the baseline model, the input abstract of the context paper and candidate paper are converted into vector representations using the sklearn TfidfVectorizer. Then the cosine similarity between the vector representations is calculated, and a threshold of 0.5 is applied to the cosine similarity to determine whether the pair of papers are related, indicated by a binary label output from the model.

5 Deep Learning Model

5.1 Training Phase

Inspired by Sentence-BERT, we decided to employ the Siamese Deep Learning Networks (Figure 4) [10] as our main model. In this architecture, two identical transformers with mean pooling are used to extract the text embeddings from two papers in

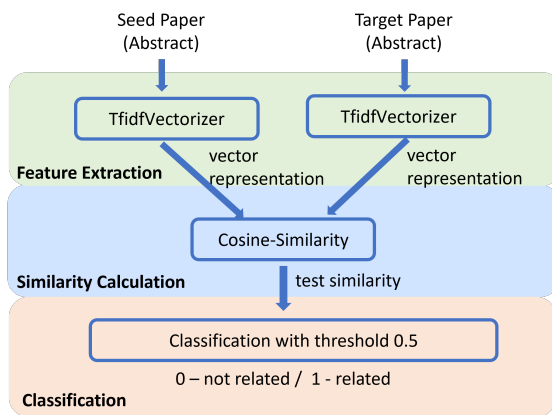


Figure 3: Baseline model architecture

the pair. Then, these two embeddings are concatenated together with their difference and fed into a binary classifier. Our networks are compatible with both BERT-based and GPT-based transformers. The output embedding has a dimension of 768, and the binary classifier is a fully-connected layer (768 x 2) for the label output.

After the training procedure, we got two trained models: the feature extraction model and the classification model. The former would be used to compute text embeddings of all papers in advance. The latter would be used to perform a pair-wise comparison on all pre-computed embeddings in the inference phase.

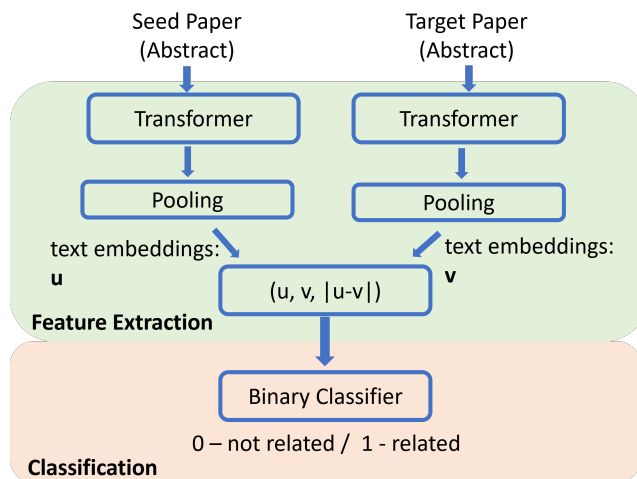


Figure 4: Deep leaning model architecture

5.2 Inference Phase

During the inference phase, the workflow would be different from the training phase, as shown in Figure 5. To save the inference time, we pre-computed text embeddings of all papers with our trained feature extraction model and saved them in a database. After the application receives the input paper from the user, it will first check whether the paper is in the database. If it is, the corresponding embeddings will be fetched directly. Otherwise, the trained feature extraction model will be invoked to compute

its embedding and insert it into the database. Afterward, the trained classifier will be called for input embeddings and each of the other embeddings in the database to determine the relatedness with a confidence value. Finally, the application will output the top k recommendations to the user.

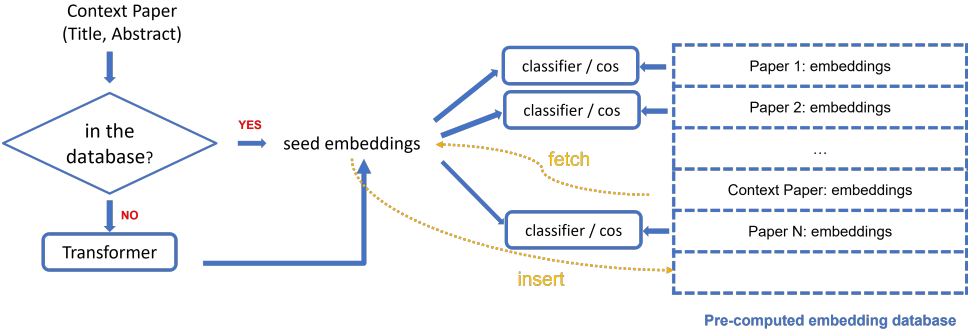


Figure 5: EZPaperSearch application architecture

6 Quantitive Results

The following table shows the quantitative results with the classifier head after we finished training. We tested multiple pre-trained transformers: GPT2-Medium, GPT2-Small, and RoBERTa-base, and used F1 score as our evaluation metric. Among all transformers, GPT2-Small achieved the best performance with reasonable processing time. Our baseline model: TFIDF model had the worst performance but the shortest processing time.

Table 2: Quantitive results

Model	Dataset	F1 Score	Processing Time
TFIDF Model (baseline)	Validation	0.78	-
	Test	0.83	0.1s
GPT2-Medium	Validation	0.92	-
	Testing	0.91	7s
GPT2-Small	Validation	0.89	-
	Testing	0.93	2s
Roberta-base	Validation	0.90	-
	Testing	0.87	2s

7 Qualitative Results

The following tables shows some examples of top 3 recommendations from our application. Overall, the recommendations are reasonable. For example, the input papers in the Figure 6 are talking about robotic control and superconductor respectively, the top 1 result from EZPaperSearch looks the most related from our perspective.

Table 3: Reasonable recommendations from EZPaperSearch (Please see the screenshots with full text in Appendix A)

Input Paper	<i>Local Gaussian process regression for real-time model-based robot control</i> High performance and compliant robot control requires accurate dynamics models which cannot be obtained analytically for sufficiently complex robot systems...
Top 1 Recommendation	<i>Real-Time Local GP Model Learning</i>
Top 2 Recommendation	<i>7DOFs Robot Numerical Approach Method with Jacobian</i>
Top 3 Recommendation	<i>Bifurcations and symmetries of optimal solutions for distributed robotic systems</i>
Input Paper	<i>Operating Experience of Superconductor Dynamic Synchronous Condenser</i> High-temperature superconductor (HTS) dynamic synchronous condensers have a small footprint...
Top 1 Recommendation	<i>Superconductor synchronous condenser for reactive power support in an electric grid</i>
Top 2 Recommendation	<i>Sliding mode control of three-phase four-leg shunt active power filter</i>
Top 3 Recommendation	<i>Superconducting fault current limiter to mitigate the effect of DC line fault in VSC-HVDC system</i>

However, we do find some cases where EZPaperSearch does not work well. In the following example, two input papers are the most related to each other based on their reference similarity. But the results from EZPaperSearch look irrelevant to the input. The embeddings from our trained transformers fail to capture all semantic meanings in this case, which leads to the misbehavior of the classifier.

Table 4: Inappropriate recommendations from EZPaperSearch (Please see the screenshots with full text in Appendix B)

Input Paper	<i>Excitation, observation, and ELF-MD: optimization criteria for high quality test sets</i> In previous work, we have shown that optimizing the number of site observations leads to more defect detection...
Top 1 Recommendation	<i>Parameter domain pruning for improving convergence of synthesis algorithms</i>
Top 2 Recommendation	<i>A feature for character recognition based on directional distance distributions</i>
Top 3 Recommendation	<i>Identity-Aware Convolutional Neural Network for Facial Expression Recognition</i>
Input Title	<i>Balanced excitation and its effect on the fortuitous detection of dynamic defects</i>
Input Abstract	Dynamic defects are less likely to be fortuitously detected than static defects because they have more stringent detection requirements...
Top 1 Recommendation	<i>γDOFs Robot Numerical Approach Method with Jacobian</i>
Top 2 Recommendation	<i>The improved depth estimation algorithm based on FTV</i>
Top 3 Recommendation	<i>The discussion of the principle and application about remanufacturing of covered mold welding</i>

8 Discussion and Learning

Overall, our model has reasonable performance on the recommendations, but the inference time is much longer than the baseline model. The reason is that the binary classifier gets invoked for each paper in the database, which significantly increases the computational overhead. The baseline model uses cosine similarity with threshold 0.5 to find the most similar items. We tried this method in our experiments, but the results looked not acceptable, especially when we provided an arbitrary sentence as the input abstract. The following two figures show the input the cosine similarity method still recommended some papers, while the classifier returned nothing. We might need to change the way of training our model to replace the classifier with the simple cosine similarity method.

Table 5: Inputs that cosine-similarity still returns some recommendations (Please see the screenshots with full text in Appendix C)

Input Title	<i>ece1786</i>
Input Abstract	ece1786
Input Title	<i>Writing Equipment and Women in Europe 1500-1900</i> (History Paper)
Input Abstract	This article examines the history and development of the material culture of...

Looking back on the whole project, we found that the workload spent on the data processing was much heavier than what we expected. We evaluated the relatedness between all unique pairs among 224,394 papers in the cleaned data set, which required significant computation time and power. We spent lots of time optimizing our code and leaning to use multiprocessing and parallel computing with Dask dataframe. It was a great learning experience for us. Moreover, after reviewing the quantitative results, we realized that the more complex model does not necessarily yield a better performance but is always more expensive. Therefore, choosing a suitable model would be a core decision for a real application design.

9 Contribution

The following table shows the contributions from each team members.

Table 6: Individual contributions

Task	Contributions
Data Processing	<ul style="list-style-type: none">• Evan wrote the initial data cleaning and labeling code• Yuhan optimized the data processing code
Algorithm	<ul style="list-style-type: none">• Evan implemented the baseline model.• Evan evaluated the baseline model.• Yuhan implemented the main model.• Yuhan trained and evaluated the main model.• Evan wrote the gradio user-facing of the software.• Yuhan implemented the architecture of the software.
Documentation	<ul style="list-style-type: none">• Evan and Yuhan created and reviewed Proposal, Proposal Presentation, Progress Report and Final Presentation together.• Evan wrote Introduction, Background and Related Work, Data Processing and Baseline Model in Final Report.• Yuhan wrote Architecture and Software, Quantitive Results, Qualitative Results and Discussion & Learning in Final Report.

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Appendices

Appendix A

EZPaperSearch

Enter a paper title

Local Gaussian process regression for real-time model-based robot control

Enter a paper abstract

High performance and compliant robot control requires accurate dynamics models which cannot be obtained analytically for sufficiently complex robot systems. In such cases, machine learning offers a promising alternative for approximating the robot dynamics using measured data. This approach offers a natural framework to incorporate unknown nonlinearities as well as to continually adapt online for changes in the robot dynamics. However, the most accurate regression methods, e.g. Gaussian processes regression (GPR) and support vector regression (SVR), suffer from exceptional high computational complexity which prevents their usage for large numbers of samples or online learning to date. Inspired by locally linear regression techniques, we propose an approximation to the standard GPR using local Gaussian processes models inspired by. Due to reduced computational cost, local Gaussian processes (LGP) can be applied for larger sample-sizes and online learning. Comparisons with other nonparametric regressions, e.g. standard GPR, ml-SVR and locally weighted projection regression (LWPR), show that LGP has higher accuracy than LWPR and close to the performance of standard GPR and ml-SVR while being sufficiently fast for online learning.

Number of Recommendations

3

Search

Classifier Recommendations

Title	Abstract
Real-Time Local GP Model Learning	For many applications in robotics, accurate dynamics models are essential. However, in some applications, e.g., in model-based tracking control, precise dynamics models cannot be obtained analytically for sufficiently complex robot systems. In such cases, machine learning offers a promising alternative for approximating the robot dynamics using measured data. However, standard regression methods such as Gaussian process regression (GPR) suffer from high computational complexity which prevents their usage for large numbers of samples or online learning to date. In this paper, we propose an approximation to the standard GPR using local Gaussian processes models inspired by [Vijayakumar et al(2005)Vijayakumar, D'Souza, and Schaal, Smolton and Ghahramani(2007)]. Due to reduced computational cost, local Gaussian processes (LGP) can be applied for larger sample-sizes and online learning. Comparisons with other nonparametric regressions, e.g., standard GPR, support vector regression (SVR) and locally weighted projection regression (LWPR), show that LGP has high approximation accuracy while being sufficiently fast for real-time online learning.
7DOFs Robot Numerical Approach Method with Jacobian	Inverse kinematics can be solved in two ways. One is an analytical method and the other is a numerical method. Although the analytical method can be obtained the exact solution, it is not only more and more difficult to solve as the degree of freedom(DOF) increases but also need to recalculate when DOF of a robot arm or Denavit-Hartenberg(DH) parameters are changed. Contrastively, the numerical method, especially, the Jacobian based numerical method can easily solve any DOF and DH-parameter were changed except singular point problem. This study will be research non-redundancy and redundancy case. Therefore, this paper is presented about Jacobian based numerical solution. In the future, this study will be adapted to 7-DOF robot arm for approaching desire position.
Bifurcations and symmetries of optimal solutions for distributed robotic systems	This paper studies bifurcations and multiple solutions of the optimal control problem for mobile robotic systems. While the existence of multiple local solutions to an optimization problem is not unexpected, the nature of the solutions are such that a relatively rich and interesting structure is present, which potentially could be exploited for controls purposes. In particular, this paper studies a group of unicycle-like autonomous mobile robots operating in a 2-dimensional obstacle-free environment. Each robot has a predefined initial state and final state and the problem is to find the optimal path between two states for every robot. The path is optimized with respect to the control effort and the deviation from a desired formation. The bifurcation parameter is the relative weight given to penalizing the deviation from the desired formation versus control effort. Numerically it is shown that as this number varies, bifurcations of solutions are obtained. Theoretic results of this paper relate to the symmetric properties of these bifurcations and the number and existence of multiple solutions for large and small values of the bifurcation parameter. Understanding the existence and nature of multiple solutions for optimization problems of this type is also of practical importance due to the ubiquity of gradient-based optimization methods where the search method will typically converge to the nearest local optimum.

EZPaperSearch

Enter a paper title

Operating Experience of Superconductor Dynamic Synchronous Condenser

Enter a paper abstract

High-temperature superconductor (HTS) dynamic synchronous condensers have a small footprint, are readily transportable, and are expected to be an economic option for providing peak and dynamic reactive compensation to a power system. HTS dynamic synchronous condensers are also inherently stable to close-in faults and can provide up to twice their nominal rating for about one minute (peak rating) during depressed voltage events. These machines also use less than half of the energy of conventional synchronous condensers because the HTS field windings operate at a constant cryogenic temperature. They are expected to be highly reliable. In October 2004, the first HTS dynamic synchronous condenser was installed on the Tennessee Valley Authority (TVA) grid serving an arc furnace where it is being exposed to a large number of transients, providing an excellent accelerated age test of the device. TVA has ordered five HTS dynamic synchronous condensers rated at 12 MW and successful operation of the first prototype machine is expected to lead to release of these orders to production by TVA, making HTS dynamic synchronous condensers the first HTS commercial product for enhancing power grid reliability.

Number of Recommendations

3

Search

Classifier Recommendations

Title	Abstract
Superconductor reactive power support in an electric grid	High Temperature Superconductor (HTS) SuperVAR dynamic synchronous condensers (DSC) developed by American Superconductor have a small foot print, are readily transportable, and are expected to be an economic option for providing peak and dynamic reactive compensation to a power system. HTS DSC machines are also inherently stable to close in faults and can provide up to twice their nominal rating for about one minute (peak rating) during depressed voltage events. Last, but not least, HTS DSC machines use less than half of the energy of a conventional synchronous condenser and about the same amount of energy as a modern Flexible AC Transmission System (FACTS) device consumes. It is expected to be highly reliable. The first HTS DSC machine is being operated at an arc furnace where it is being tested for its ability to mitigate flicker and provide dynamic power factor compensation. This location also exposes the machine to a large number of transients providing an excellent accelerated age test of the device. This paper describes features and test results of the HTS DSC.
Sliding mode control of three-phase four-leg shunt active power filter	This paper deals with the application of a sliding mode strategy to control a three-phase shunt active power filter (APF). The APF consists of four-leg voltage source inverter (VSI) bridge. The APF ensures full compensation for harmonic phase currents, harmonic neutral current, and reactive and unbalanced nonlinear load currents. It also regulates its self-sustaining dc bus voltage. The reference currents are obtained from the nonlinear load currents. To control the APF, the selection of the sliding mode switching functions is based on the multivariable state space model in the synchronous dq0 reference frame. The control law has a switching component forcing the system's trajectory to the sliding surface and a continuous component valid on the sliding surface. The stability of the closed loop system is proved by means of Lyapunov stability criterion. The robustness over a wide range of operation is another property of the control. Simulations are conducted to verify the analytical analysis of the control.
Superconducting fault current limiter to mitigate the effect of DC line fault in VSC-HVDC system	Voltage source converter based HVDC systems involving overhead transmission lines are prone to severe over-voltages during line faults. At present, they find applications only in back to back and/or underground cable transmission, with low power ratings. A conventional HVDC system suppresses the dc fault very well with the controllers and smoothing reactors while the same is not true with voltage source converter based HVDC systems. This necessitates the operation of some kind of protective devices. A superconducting fault current limiter, in this regard, is a possible device which can mitigate the effects of dc line faults. In this work, it is aimed to evaluate the dynamic performance of VSC-HVDC system integrated with a superconducting fault current limiter. The resistive superconducting fault current limiter is modeled in MATLAB and is interfaced with low voltage VSC-HVDC system, in PSCAD/EMTDC environment. The results of analysis for various ac and dc fault conditions are presented.

Figure 6: Reasonable recommendations from EZPaperSearch

Appendix B

EZPaperSearch

Enter a paper title

Excitation, observation, and ELP-MD: optimization criteria for high quality test sets

Enter a paper abstract

In previous work, we have shown that optimizing the number of site observations leads to more defect detection. However, for increasingly difficult defects, optimizing patterns for balanced random excitation also enhances test effectiveness. We can also reduce the effect of undetected defects by choosing tests that minimize the likelihood of field failures.

Number of Recommendations

3

Search

Classifier Recommendations

Title	Abstract
Parameter domain pruning for improving convergence of synthesis algorithms	This paper presents a parameter domain pruning method. Parameter domain pruning aims to identify parameter sub-domains that are more likely to produce feasible and good design solutions. These parameter sub-domains are found using the proposed simplified affine transforms (SAT) operators. Selected variable sub-domains can then be used as input to exploration-based synthesis tools and help improve the convergence of synthesis algorithms.
A Feature for Character recognition based on directional distance distributions	The performance of a character recognition system depends heavily on what features are being used. Though many kinds of features have been developed and their test performances on a standard database have been reported, there is still room to improve the recognition rate by developing an improved feature. The authors propose a new feature based on DDD (directional distance distribution) information. This new concept regards the input pattern array as being circular. It also contains very rich information by encoding in one representation both the white/black distribution and the directional distance distribution. A test performed on the CENPARMI handwritten numeral database showed a promising result of 97.3% recognition with a neural network classifier using the DDD feature.
Identity-Aware Convolutional Neural Network for Facial Expression Recognition	Facial expression recognition suffers under realworld conditions, especially on unseen subjects due to high inter-subject variations. To alleviate variations introduced by personal attributes and achieve better facial expression recognition performance, a novel identity-aware convolutional neural network (IACNN) is proposed. In particular, a CNN with a new architecture is employed as individual streams of a bi-stream identity-aware network. An expression-sensitive contrastive loss is developed to measure the expression similarity to ensure the features learned by the network are invariant to expression variations. More importantly, an identity-sensitive contrastive loss is proposed to learn identity-related information from identity labels to achieve identity-invariant expression recognition. Extensive experiments on three public databases including spontaneous facial expression database have shown that the proposed IACNN achieves promising results in real world.

EZPaperSearch

Enter a paper title

Balanced excitation and its effect on the fortuitous detection of dynamic defects

Enter a paper abstract

Dynamic defects are less likely to be fortuitously detected than static defects because they have more stringent detection requirements. We show that (in addition to more site observations) balanced excitation is essential for detection of these defects, and we present a metric for estimating this degree of balance. We also show that excitation balance correlates with the parameter j in the MPG-D defective part level model.

Number of Recommendations

3

Search

Classifier Recommendations

Title	Abstract
7DOFs Robot Numerical Approach Method with Jacobian	Inverse kinematics can be solved in two ways. One is an analytical method and the other is a numerical method. Although the analytical method can be obtained the exact solution, it is not only more and more difficult to solve as the degree of freedom(DOF) increases but also need to recalculate when DOF of a robot arm or Denavit-Hartenberg(DH) parameters are changed. Contrastively, the numerical method, especially, the Jacobian based numerical method can easily solve any DOF and DH-parameter were changed except singular point problem. This study will be research non-redundancy and redundancy case. Therefore, this paper is presented about Jacobian based numerical solution. In the future, this study will be adapted to 7-DOF robot arm for approaching desire position.
The improved depth estimation algorithm based on FTV	Depth estimation is one of the key technologies of FTV system. To increase depth accuracy, a depth estimation method which can preserve temporal consistency is proposed. For current view, depth values of the previous frame and motion information between current and its previous frame are used as constraint conditions to estimate depth map of current frame, thus preserve temporal consistency of depth maps in the two successive frames. Experiment results show that not only accuracy of depth edges in depth maps is increased, but also temporal consistency of depth maps is preserved well.
The discussion of the principle and application about remanufacturing of covered mold welding	This article is describing the type of spares surface of failure and common restore and recreating technology. Covered mold welding Remanufacturing was first put forward, explain its principle and explore process method and application scope. Covered mold welding Remanufacturing is based on the principle of brazing welding and electro slag welding, the method is in the help of the mold which is accorded well with restored spares surface, in induction heating the damage surface of the parts will be filled with deposition to be repaired, at the same time, the shape and size of the surface of cladding layer can be controlled. It is a new Remanufacturing which differs from the traditional technology.

Figure 7: Inappropriate recommendations from EZPaperSearch

Appendix C

EZPaperSearch

Enter a paper title

Enter a paper abstract

Number of Recommendations

Search

Classifier Recommendations

Title	Abstract

Cosine Similarity Recommendations

Title	Abstract
Sufficient Conditions for Fast Switching Synchronization in Time-Varying Network Topologies	In previous work [J. D. Skufca and E. Bollt, <i>Mathematical Biosciences and Engineering</i> , 1 (2004), pp. 347-359], empirical evidence indicated that a time-varying network could propagate sufficient in...
Deblurring Low-Light Images with Light Streaks	Images taken in low-light conditions with handheld cameras are often blurry due to the required long exposure time. Although significant progress has been made recently on image deblurring, state-of-the-art approaches often fail on low-light images, as these images do not contain a sufficient number of salient features that deblurring methods rely on. On the other hand, light streaks are common phenomena in low-light images that contain rich blur information, but have not been extensively explored in previous approaches. In this work, we propose a new method that utilizes light streaks to help deblur low-light images. We introduce a non-linear blur model that explicitly models light streaks and their underlying light sources, and poses them as constraints for estimating the blur kernel in an optimization framework. Our method also automatically detects useful light streaks in the input image. Experimental results show that our approach obtains good results on challenging real-world examples that no other methods could achieve before.
Implementation of social technologies for Open Course Ware OCW platforms	The present work focused on the inclusion of social components to the Open Course Ware (OCW) platforms, with this purpose was taken as case study the Technical University of Loja (UTPL), to demonstrate the level of knowledge and use social networks and platforms OCW identifying acceptance and feasibility of integrating social platforms this kind of functionality. Based on the results obtained are developed and implemented social features for OCW platform - learning.

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Building a Flexible Service Architecture for User Controlled Hybrid Clouds	Virtualization and broadband Internet connections enabled existing technologies to form up under the nebulous term cloud. Cloud computing promises near infinite scalability and cost reduction by pay per use agreements. However for data outsourced to existing cloud solutions - which can be considered synonymous with unknown locations and potentially hostile environments - the security protection objectives can not be guaranteed. We present an approach that enables users to benefit from cloud computing and retain data sovereignty.

Figure 8: Incorrect recommendations with cosine similarity method