Welcome Message from the ICDAR 2017
General and Executive Chairs.................................................................xxiv
Welcome Message from the ICDAR 2017
Technical Program Chairs........................................................................xxvi
ICDAR 2017 Organizers...........................................................................xxviii
ICDAR 2017 Technical Program Committee...........................................xxix
ICDAR 2017 Sponsors..............................................................................xxxii
ICDAR 2017 Keynote Speeches.................................................................xxxiii

14th IAPR International Conference on Document Analysis and Recognition (ICDAR2017)

Oral Session 1: Character Recognition I
Improving Offline Handwritten Chinese Character Recognition by Iterative Refinement .................................................................5
   Xiao Yang, Dafang He, Zihan Zhou, Daniel Kifer, and C. Lee Giles
High Performance Text Recognition Using a Hybrid Convolutional-LSTM Implementation .................................................................11
   Thomas M. Breuel
Error Detection and Corrections in Indic OCR Using LSTMs .................................17
   Rohit Saluja, Devaraj Adiga, Parag Chaudhuri, Ganesh Ramakrishnan, and Mark Carman
Qumran Letter Restoration by Rotation and Reflection Modified PixelCNN ........................................23
   Lior Uzan, Nachum Dershowitz, and Lior Wolf
Oral Session 2: Graphics Recognition
Pyramidal Stochastic Graphlet Embedding for Document Pattern Classification .............................................33
    Anjan Dutta, Pau Riba, Josep Lladós, and Alicia Fornés

The MUSCIMA++ Dataset for Handwritten Optical Music Recognition .............................................................39
    Jan Hajič, Jr., and Pavel Pecina

Partitioning Open Plan Areas in Floor Plans ........................................................................................................47
    Anuradha Madugalla, Kim Marriott, and Simone Marinai

Image Operator Learning Coupled with CNN Classification and Its Application to Staff Line Removal ..........................................................53
    Frank Dennis Julca Aguilar and Nina S.T. Hirata

Oral Session 3: Offline Handwriting Recognition I
Sequence Discriminative Training for Offline Handwriting Recognition by an Interpolated CTC and Lattice-Free MMI Objective Function .................................................................61
    Wenping Hu, Meng Cai, Kai Chen, Haisong Ding, Lei Sun, Sen Liang, Xiongjian Mo, and Qiang Huo

Are Multidimensional Recurrent Layers Really Necessary for Handwritten Text Recognition? ..........................................................67
    Joan Puigcerver

Cortical-Inspired Open-Bigram Representation for Handwritten Word Recognition ..........................................................73
    Theodore Bluche, Christopher Kermorvant, Claude Touzet, and Hervé Glotin

Handwritten Chinese Text Recognition Using Separable Multi-Dimensional Recurrent Neural Network ..........................................................79
    Yi-Chao Wu, Fei Yin, Zhuo Chen, and Cheng-Lin Liu

Oral Session 4: Document Image Processing
Automatic Static/Variable Content Separation in Administrative Document Images ..........................................................87
    David Aldavert, Marçal Rusiñol, and Ricardo Toledo

An Iterative Refinement Framework for Image Document Binarization with Bhattacharyya Similarity Measure ..........................................................93
    Ning Liu, Dongxiang Zhang, Xing Xu, Wenju Liu, Dengfeng Ke, Long Guo, Shengkun Shi, Hui Liu, and Lijiang Chen

Document Image Binarization with Fully Convolutional Neural Networks ..........................................................99
    Chris Tensmeyer and Tony Martinez
# Poster Session 1

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robust Math Formula Recognition in Degraded Chinese Document Images</td>
<td>113</td>
</tr>
<tr>
<td>Ning Liu, Dongxiang Zhang, Xing Xu, Long Guo, Lijiang Chen, Wenju Liu, and Dengfeng Ke</td>
<td></td>
</tr>
<tr>
<td>Chinese Writer Identification Using Contour-Directional Feature and Character Pair Similarity Measurement</td>
<td>119</td>
</tr>
<tr>
<td>Yu-Jie Xiong and Lu Yue</td>
<td></td>
</tr>
<tr>
<td>A Complete Scheme of Spatially Categorized Glyph Recognition for the Transliteration of Balinese Palm Leaf Manuscripts</td>
<td>125</td>
</tr>
<tr>
<td>Made Windu Antara Kesiman, Jean-Christophe Burie, and Jean-Marc Ogier</td>
<td></td>
</tr>
<tr>
<td>Impact of Ligature Coverage on Training Practical Urdu OCR Systems</td>
<td>131</td>
</tr>
<tr>
<td>Muhammad Ferjad Naeem, Noor ul Sehr Zia, Aqsa Ahmed Awan, Faisal Shafait, and Adnan ul Hasan</td>
<td></td>
</tr>
<tr>
<td>Handwriting Recognition with Multigrams</td>
<td>137</td>
</tr>
<tr>
<td>Wassim Swaileh, Thierry Paquet, Yann Souillard, and Pierrick Tranouez</td>
<td></td>
</tr>
<tr>
<td>Compact and Efficient WFST-Based Decoders for Handwriting Recognition</td>
<td>143</td>
</tr>
<tr>
<td>Meng Cai and Qiang Huo</td>
<td></td>
</tr>
<tr>
<td>Supervised Feature Learning via Within-Class Reconstruction</td>
<td>149</td>
</tr>
<tr>
<td>Yunxue Shao, Jiantao Zhou, and Guanglai Gao</td>
<td></td>
</tr>
<tr>
<td>Combining Convolutional Neural Networks and LSTMs for Segmentation-Free OCR</td>
<td>155</td>
</tr>
<tr>
<td>Stephen Rawls, Huaigu Cao, Senthil Kumar, and Prem Natarajan</td>
<td></td>
</tr>
<tr>
<td>Sequence-to-Label Script Identification for Multilingual OCR</td>
<td>161</td>
</tr>
<tr>
<td>Yasuhisa Fujii, Karel Driesen, Jonathan Baccash, Ash Hurst, and Ashok C. Popat</td>
<td></td>
</tr>
<tr>
<td>Selecting Automatically Pre-Processing Methods to Improve OCR Performances</td>
<td>169</td>
</tr>
<tr>
<td>Quang Anh Bui, David Mollard, and Salvatore Tabbone</td>
<td></td>
</tr>
<tr>
<td>Legibility and Aesthetic Analysis of Handwriting</td>
<td>175</td>
</tr>
<tr>
<td>Chandranath Adak, Bidyut B. Chaudhuri, and Michael Blumenstein</td>
<td></td>
</tr>
<tr>
<td>New Morphological Markovian Approach for Analysis and Recognition of Open Arabic Canonical Vocabulary</td>
<td>183</td>
</tr>
<tr>
<td>Imen Ben Cheikh and Anas Laffet</td>
<td></td>
</tr>
<tr>
<td>Online Handwritten Mongolian Word Recognition Using a Novel Sliding Window Method with Recurrent Neural Networks</td>
<td>189</td>
</tr>
<tr>
<td>Ji Liu, Long-Long Ma, and Jian Wu</td>
<td></td>
</tr>
<tr>
<td>Topic</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Complexity-Based Biometric Signature Verification</td>
<td>195</td>
</tr>
<tr>
<td>Ruben Tolosana, Ruben Vera-Rodriguez, Richard Guest, Julian Fierrez, and Javier Ortega-Garcia</td>
<td></td>
</tr>
<tr>
<td>A Long Term Memory Recognition Framework on Multi-Complexity Motion Gestures</td>
<td>201</td>
</tr>
<tr>
<td>Songbin Xu and Yang Xue</td>
<td></td>
</tr>
<tr>
<td>Stroke-Order Normalization for Online Bangla Handwriting Recognition</td>
<td>206</td>
</tr>
<tr>
<td>Nilanjana Bhattacharya, Umapada Pal, and Partha Pratim Roy</td>
<td></td>
</tr>
<tr>
<td>Early Recognition of Handwritten Gestures Based on Multi-Classifier Reject Option</td>
<td>212</td>
</tr>
<tr>
<td>Zhaoxin Chen, Eric Anquetil, Christian Viard-Gaudin, and Harold Mouchère</td>
<td></td>
</tr>
<tr>
<td>Personalized Hand Writing Recognition Using Continued LSTM Training</td>
<td>218</td>
</tr>
<tr>
<td>Pragya Paramita Sahu, Vikrant Singh, Indra Kiran, Viswanath Veera, Thanda Abhinav, Ankit Vijay, and Shankar M. Venkatesan</td>
<td></td>
</tr>
<tr>
<td>Browsing through Closed Books: Fully Automatic Book Page Extraction from a 3-D X-Ray CT Volume</td>
<td>224</td>
</tr>
<tr>
<td>Daniel Stromer, Vincent Christlein, Tobias Schoen, Wolfgang Holub, and Andreas Maier</td>
<td></td>
</tr>
<tr>
<td>CNN Based Page Object Detection in Document Images</td>
<td>230</td>
</tr>
<tr>
<td>Xiaohan Yi, Liangcai Gao, Yuan Liao, Xiaode Zhang, Runtao Liu, and Zhuoren Jiang</td>
<td></td>
</tr>
<tr>
<td>A Robust and Binarization-Free Approach for Text Line Detection in Historical Documents</td>
<td>236</td>
</tr>
<tr>
<td>Tobias Gruuening, Gundram Leifert, Tobias Strauss, and Roger Labahn</td>
<td></td>
</tr>
<tr>
<td>Enhancing Table of Contents Extraction by System Aggregation</td>
<td>242</td>
</tr>
<tr>
<td>Thi-Tuyet-Hai Nguyen, Antoine Doucet, and Mickael Coustaty</td>
<td></td>
</tr>
<tr>
<td>D-StaR: A Generic Method for Stamp Segmentation from Document Images</td>
<td>248</td>
</tr>
<tr>
<td>Junaid Younas, Muhammad Zeshan Afzal, Muhammad Imran Malik, Faisal Shafait, Paul Lukowicz, and Sheraz Ahmed</td>
<td></td>
</tr>
<tr>
<td>Multi-Scale Multi-Task FCN for Semantic Page Segmentation and Table Detection</td>
<td>254</td>
</tr>
<tr>
<td>Dafang He, Scott Cohen, Brian Price, Daniel Kifer, and C. Lee Giles</td>
<td></td>
</tr>
<tr>
<td>Academic Community Explorer (ACE) for Syntactic, Semantic and Pragmatic Document Analysis</td>
<td>262</td>
</tr>
<tr>
<td>Akansha Bhardwaj, Dominique Mercier, Hisham Hashmi, Sheraz Ahmed, and Andreas Dengel</td>
<td></td>
</tr>
<tr>
<td>A Rectangle Mining Method for Understanding the Semantics of Financial Tables</td>
<td>268</td>
</tr>
<tr>
<td>Xilun Chen, Laura Chiticariu, Marina Danilevsky, Alexandre Evfimievski, and Prithviraj Sen</td>
<td></td>
</tr>
</tbody>
</table>
Relating Articles Textually and Visually .................................................................274
    Nachum Dershowitz, Daniel Labenski, Adi Silberpfennig, Lior Wolf, and Yaron Tsur
Selecting Fine-Tuned Features for Layout Analysis of Historical Documents ........281
    Hao Wei, Mathias Seuret, Marcus Liwicki, Rolf Ingold, and Pei Fu
Bio-Inspired Modeling for the Enhancement of Historical Handwritten Documents .................................................................287
    Konstantinos Zagoris and Ioannis Pratikakis
Alignment of Historical Handwritten Manuscripts Using Siamese Neural Network .................................................................................................293
    Majeed Kassis, Jumana Nassour, and Jihad El-Sana
Local Enlacement Histograms for Historical Drop Caps Style Recognition ........299
    Michaël Clément, Mickaël Coustaty, Camille Kurtz, and Laurent Wendling
anyOCR: An Open-Source OCR System for Historical Archives ..........................305
    Syed Saqib Bukhari, Ahmad Kadi, Mohammad Ayman Jouneh, Fahim Mahmood Mir, and Andreas Dengel
Preparatory KWS Experiments for Large-Scale Indexing of a Vast Medieval Manuscript Collection in the HIMANIS Project .........................................................311
    Théodore Bluche, Sebastien Hamel, Christopher Kermorvant, Joan Puigcerver, Dominique Stutzmann, Alejandro H. Toselli, and Enrique Vidal
A Machine Learning System for Assisting Neophyte Researchers in Digital Libraries .................................................................................................317
    Bissan Audeh, Michel Beigbeder, and Christine Largeron
Weakly Supervised Text Attention Network for Generating Text Proposals in Scene Images .................................................................324
    Li Rong, En MengYi, Li JianQiang, and Zhang HaiBin
A Unified Video Text Detection Method with Network Flow ..............................331
    Xue-Hang Yang, Wenhao He, Fei Yin, and Cheng-Lin Liu
Segments Graph-Based Approach for Document Capture in a Smartphone Video Stream .................................................................................................337
    Alexander Zhukovsky, Dmitriy Nikolaev, Vladimir Arlazarov, Vasilyi Postnikov, Dmitriy Polevoy, Natalya Skoryukina, Timofey Chernov, Julia Shemiakina, Arseniy Mukovozov, Ivan Konovalenko, and Mikhail Povolotsky
Benchmarking Keypoint Filtering Approaches for Document Image Matching ........343
    Emilien Royer, Joseph Chazalon, Marçal Rusiñol, and Frédéric Bouchara
Temporal Integration for Word-Wise Caption and Scene Text Identification ........349
    Sangheeta Roy, Palaihnakote Shivakumara, Umapada Pal, Tong Lu, and Ainuddin Wahid Bin Abdul Wahab
Whiteboard Video Summarization via Spatio-Temporal Conflict Minimization ........355
    Kenny Davila and Richard Zanibbi
Learning Spatially Embedded Discriminative Part Detectors for Scene Character Recognition ..........................................................363
   Yanna Wang, Cunzhao Shi, Baihua Xiao, and Chunheng Wang

Bag of Local Convolutional Triplets for Script Identification in Scene Text ..........................................................369
   Jan Zdenek and Hideki Nakayama

Text Proposals Based on Windowed Maximally Stable Extremal Region for Scene Text Detection ..................................................376
   Feng Su, Wenjun Ding, Lan Wang, Susu Shan, and Hailiang Xu

Local Discriminant Training and Global Optimization for Convolutional Neural Network Based Handwritten Chinese Character Recognition ..................................................382
   Xiangsheng Zeng, Donglai Xiang, Liangrui Peng, Changsong Liu, and Xiaqing Ding

Analysis of Convolutional Neural Networks for Document Image Classification ..................................................388
   Chris Tensmeyer and Tony Martinez

Component Awareness in Convolutional Neural Networks ..................................................................................394
   Brian Kenji Iwana, Letao Zhou, Kumiko Tanaka-Isihi, and Seiichi Uchida

Online Signature Verification Using Recurrent Neural Network and Length-Normalized Path Signature Descriptor ..................................................400
   Songxuan Lai, Lianwen Jin, and Weixin Yang

CloudScan - A Configuration-Free Invoice Analysis System Using Recurrent Neural Networks ..................................................406
   Rasmus Berg Palm, Ole Winther, and Florian Laws

Fully Convolutional Neural Networks for Newspaper Article Segmentation ..................................................414
   Benjamin Meier, Thilo Stadelmann, Jan Stampfl, Marek Arnold, and Mark Cieliebak

DANIEL: A Deep Architecture for Automatic Analysis and Retrieval of Building Floor Plans ..................................................420
   Divya Sharma, Nitin Gupta, Chiranjoy Chattopadhyay, and Sameep Mehta

Complex Document Classification and Localization Application on Identity Document Images ..................................................426
   Ahmad Montaser Awal, Nabil Ghanmi, Ronan Sicre, and Teddy Furon

Classification of Graphomotor Impressions Using Convolutional Neural Networks: An Application to Automated Neuro-Psychological Screening Tests ..................................................432
   Haris Bin Nazar, Momina Moetesum, Shoaih Ehsan, Imran Siddiqi, Khurram Khurshid, Nicole Vincent, and Klaus D. McDonald-Maier
Oral Session 5: Character Recognition II
Semi-Supervised Transfer Learning for Convolutional Neural Network Based Chinese Character Recognition ..................................................................................................................441
Yejun Tang, Bing Wu, Liangrui Peng, and Changsong Liu
Extremely Sparse Deep Learning Using Inception Modules with Dropfilters ..........................................................................................................................448
Woo-Young Kang, Kyung-Wha Park, and Byoung-Tak Zhang
Building a Compact MQDF Classifier by Sparse Coding and Vector Quantization Technique ...........................................................................................................454
Xiaohua Wei, Shujing Lu, and Yue Lu
A Comprehensive Analysis of Misclassified Handwritten Chinese Character Samples by Incorporating Human Recognition ........................................................................460
Kaihuan Liang, Lianwen Jin, Zecheng Xie, Xuefeng Xiao, and Weiguo Huang
A Noise-Resilient Super-Resolution Framework to Boost OCR Performance .............................................................................................................................466
Manoj Sharma, Anupama Ray, Santanu Chaudhury, and Brejesh Lall

Oral Session 6: Spotting and Information Retrieval
Improving Information Retrieval in Multiwriter Scenario by Exploiting the Similarity Graph of Document Terms ........................................................................................................475
Pau Riba, Anjan Dutta, Sounak Dey, Josep Lladós, and Alicia Fornés
Query-by-Online Word Spotting Revisited: Using CNNs for Cross-Domain Retrieval .............................................................................................................................481
Sebastian Sudholt, Leonard Rothacker, and Gernot A. Fink
Nonlinear Manifold Embedding on Keyword Spotting Using t-SNE ..............................................................................................................................487
George Retsinas, Nikolaos Stamatopoulos, Georgios Louloudis, Giorgos Sfikas, and Basilis Gatos
Evaluating Word String Embeddings and Loss Functions for CNN-Based Word Spotting ...................................................................................................................493
Sebastian Sudholt and Gernot A. Fink
LSDE: Levenshtein Space Deep Embedding for Query-by-String Word Spotting .........................................................................................................................499
Lluis Gómez, Marçal Rusiñol, and Dimosthenis Karatzas

Oral Session 7: Offline Handwriting Recognition II
A Compact CNN-DBLSTM Based Character Model for Offline Handwriting Recognition with Tucker Decomposition .........................................................................................507
Haisong Ding, Kai Chen, Ye Yuan, Meng Cai, Lei Sun, Sen Liang, and Qiang Huo
A PHOC Decoder for Lexicon-Free Handwritten Word Recognition ..........................................................................................................................513
Giorgos Sfikas, George Retsinas, and Basilis Gatos
An Open Vocabulary OCR System with Hybrid Word-Subword Language Models ......................................................................................................................................................519
   Meng Cai, Wenhong Hu, Kai Chen, Lei Sun, Sen Liang, Xiongjian Mo, and Qiang Huo

Simultaneous Script Identification and Handwriting Recognition via Multi-Task Learning of Recurrent Neural Networks ...................................................................................................525
   Zhuo Chen, Yichao Wu, Fei Yin, and Cheng-Lin Liu

**Oral Session 8: Segmentation and Layout Analysis**

A Data Driven Approach for Compound Figure Separation Using Convolutional Neural Networks ..................................................................................................................................................533
   Satoshi Tsutsui and David J. Crandall

Page Segmentation for Historical Handwritten Documents Using Fully Convolutional Networks ..................................................................................................................................................................................541
   Yue Xu, Wenhao He, Fei Yin, and Cheng-Lin Liu

A General Approach for Handwritten Digits Segmentation Using Spectral Clustering ...........................................................................................................................................................................547
   Cheng Chen and Jun Guo

A Deep Learning-Based Formula Detection Method for PDF Documents ........................................................................................................................................................................................553
   Liangcai Gao, Xiaohan Yi, Yuan Liao, Zhuoren Jiang, Zuooyu Yan, and Zhi Tang

**Poster Session 2**

Vacuity Measure for Handwritten Character Analysis ........................................................................................................................................................................................561
   Van-Cuong Kieu, Dominique Stutzmann, and Nicole Vincent

Improving Thai Optical Character Recognition Using Circular-Scan Histogram ..........................................................................................................................................................................................567
   Natsuda Kaorthanthong, Thanaruk Theeramunkong, and Jinhee Chun

Propagation Based Prototype Prediction ........................................................................................................................................................................................................................573
   Tonghua Su, Hongliang Dai, Ce Liu, and Lijun Yu

Radical-Based Chinese Character Recognition via Multi-Labeled Learning of Deep Residual Networks ...........................................................................................................................................................................579
   Tie-Qiang Wang, Fei Yin, and Cheng-Lin Liu

Segmentation-Free Printed Traditional Mongolian OCR Using Sequence to Sequence with Attention Model ..........................................................................................................................................................................................585
   Hui Zhang, Hongxi Wei, Feilong Bao, and Guanglai Gao

Layout and Perspective Distortion Independent Recognition of Captured Chinese Document Image ..........................................................................................................................................................................................591
   Yanwei Wang, Yuefang Sun, and Changsong Liu

Glyph-Based Data Augmentation for Accurate Kanji Character Recognition ..................................................................................................................................................................................................................597
   Kenichiro Ofusa, Tomo Miyazaki, Yoshihiro Sugaya, and Shinichiro Omachi
Similar Handwritten Chinese Character Recognition Using Hierarchical CNN Model ......................................................................................................................................................603
  Qingqing Wang and Yue Lu

Integrating Bilingual Named Entities Lexicon with Conditional Random Fields Model for Arabic Named Entities Recognition .................................................................................................................................................................609
  Emna Hkiri, Souheyl Mallat, and Mounir Zrigui

Automating Transliteration of Cuneiform from Parallel Lines with Sparse Data ........................................................................................................................................................................................................615
  Bartosz Bogacz, Maximilian Klingmann, and Hubert Mara

A Comprehensive Survey on Handwriting and Computerized Graphology ........................................................................................................................................................................................................621
  Afnan H. Garoot, Meadeh Safar, and Ching Y. Suen

Core Region Detection for Off-Line Unconstrained Handwritten Latin Words Using Word Envelops ................................................................................................................................................................................................627
  Shilpa Pandey and Gaurav Harit

Self-Training of BLSTM with Lexicon Verification for Handwriting Recognition ..................................................................................................................................................633
  Bruno Stuner, Clément Chatelain, and Thierry Paquet

Data Augmentation for Recognition of Handwritten Words and Lines Using a CNN-LSTM Network .........................................................................................................................................................................................................639
  Curtis Wigington, Seth Stewart, Brian Davis, Bill Barrett, Brian Price, and Scott Cohen

Gated Convolutional Recurrent Neural Networks for Multilingual Handwriting Recognition ................................................................................................................................................................................................646
  Théodore Bluche and Ronaldo Messina

Biometric Signature Verification Using Recurrent Neural Networks ................................................................................................................................................................................................................652
  Ruben Tolosana, Ruben Vera-Rodriguez, Julian Fierrez, and Javier Ortega-Garcia

A Hybrid Model for End to End Online Handwriting Recognition ...............................................................................................................................................................................................................658
  Partha Sarathi Mukherjee, Bappaditya Chakraborty, Ujjwal Bhattacharya, and Swapan Kumar Parui

PS-LSTM: Capturing Essential Sequential Online Information with Path Signature and LSTM for Writer Identification ................................................................................................................................................................................................664
  Manfei Liu, Lianwen Jin, and Zecheng Xie

Geometric Object 3D Reconstruction from Single Line Drawing Image with Bottom-Up and Top-Down Classification and Sketch Generation ........................................................................................................................................................................................................670
  Ting Guo, Yongtao Wang, Yafeng Zhou, Zheqi He, and Zhi Tang

A System for Creating Automatic Navigation among Architectural and Construction Documents ................................................................................................................................................................................................677

xiii
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>VASESKETCH: Automatic 3D Representation of Pottery from Paper Catalog</td>
<td>683</td>
</tr>
<tr>
<td>Francesco Banterle, Barak Itkin, Matteo Dellepiane, Lior Wolf, Marco Callieri, Nachum Dershowitz, and Roberto Scopigno</td>
<td></td>
</tr>
<tr>
<td>Recognition of Handwritten Music Symbols with Convolutional Neural Codes</td>
<td>691</td>
</tr>
<tr>
<td>Jorge Calvo-Zaragoza, Antonio-Javier Gallego, and Antonio Pertusa</td>
<td></td>
</tr>
<tr>
<td>Script Identification Based on Nonsubsampled Contourlet Transform</td>
<td>697</td>
</tr>
<tr>
<td>Xing-Kun Han, Alimjan Aysa, Nurbiya Yadikar, Hornisa Mamat, and Kurban Ubul</td>
<td></td>
</tr>
<tr>
<td>A Convolutional Neural Network Based Two-Stage Document Deblurring</td>
<td>703</td>
</tr>
<tr>
<td>Jile Jiao, Jun Sun, and Naoi Satoshi</td>
<td></td>
</tr>
<tr>
<td>Using Convolutional Encoder-Decoder for Document Image Binarization</td>
<td>708</td>
</tr>
<tr>
<td>Xuqun Peng, Huaigu Cao, and Prem Natarajan</td>
<td></td>
</tr>
<tr>
<td>Ensembles for Graph-Based Keyword Spotting in Historical Handwritten Documents</td>
<td>714</td>
</tr>
<tr>
<td>Michael Stauffer, Andreas Fischer, and Kaspar Riesen</td>
<td></td>
</tr>
<tr>
<td>Class-Adapted Blind Deblurring of Document Images</td>
<td>721</td>
</tr>
<tr>
<td>Marina Ljubenovic, Lina Zhuang, and Mário A.T. Figueiredo</td>
<td></td>
</tr>
<tr>
<td>Deep Networks for Degraded Document Image Binarization through Pyramid Reconstruction</td>
<td>727</td>
</tr>
<tr>
<td>Gaofeng Meng, Kun Yuan, Ying Wu, Shiming Xiang, and Chunhong Pan</td>
<td></td>
</tr>
<tr>
<td>Robust, Simple Page Segmentation Using Hybrid Convolutional MDLSTM Networks</td>
<td>733</td>
</tr>
<tr>
<td>Thomas M. Breuel</td>
<td></td>
</tr>
<tr>
<td>A Perceptual Image Hashing Algorithm for Hybrid Document Security</td>
<td>741</td>
</tr>
<tr>
<td>Sébastien Eskenazi, Boris Bodin, Petra Gomez-Krämer, and Jean-Marc Ogier</td>
<td></td>
</tr>
<tr>
<td>Document Layout Analysis Using Multigaussian Fitting</td>
<td>747</td>
</tr>
<tr>
<td>Laiphangbam Melinda, Raghu Ghanapuram, and Chakravarthy Bhagvati</td>
<td></td>
</tr>
<tr>
<td>Localizing and Recognizing Labels for Multi-Panel Figures in Biomedical Journals</td>
<td>753</td>
</tr>
<tr>
<td>Jie Zou, Sameer Antani, and George Thoma</td>
<td></td>
</tr>
<tr>
<td>A Font Setting Based Bayesian Model to Extract Mathematical Expression in PDF Files</td>
<td>759</td>
</tr>
<tr>
<td>Xing Wang and Jyh-Charn Liu</td>
<td></td>
</tr>
<tr>
<td>Wikipedia-Based Entity Semantifying in Open Information Extraction</td>
<td>765</td>
</tr>
<tr>
<td>Qiuhao Lu and Youtian Du</td>
<td></td>
</tr>
<tr>
<td>Table Detection Using Deep Learning</td>
<td>771</td>
</tr>
<tr>
<td>Azka Gilani, Shah Rukh Qasim, Imran Malik, and Faisal Shafait</td>
<td></td>
</tr>
</tbody>
</table>
Table Recognition in Heterogeneous Documents Using Machine Learning ........................................777
   Sheikh Faisal Rashid, Abdullah Akmal, Muhammad Adnan, Ali Adnan Aslam, and Andreas Dengel
Chronological Profiling for Paleography ...................................................................................................783
   Nicholas R. Howe and Stephanie Xie
Convolutional Neural Networks for Figure Extraction in Historical Technical Documents ..........................................................789
   Chun-Nam Yu, Caleb Carson Levy, and Iraj Saniee
The Handwritten Sundanese Palm Leaf Manuscript Dataset from 15th Century .....................................................796
   Mira Suryani, Erick Paulus, Setiawan Hadi, Undang A. Darsa, and Jean-Christophe Burie
R-PHOC: Segmentation-Free Word Spotting Using CNN ..................................................................................801
   Suman K. Ghosh and Ernest Valveny
Deep Residual Text Detection Network for Scene Text .......................................................................................807
   Xiangyu Zhu, Yingying Jiang, Shuli Yang, Xiaobing Wang, Wei Li, Pei Fu, Hua Wang, and Zhenbo Luo
A Robust Approach to Detecting Text from Images of Whiteboards and Handwritten Notes ..................................................813
   Wei Jia, Lei Sun, Zhuoyao Zhong, Xiongjian Mo, Guoen Ma, and Qiang Huo
Attention Based RNN Model for Document Image Quality Assessment ..........................................................819
   Pengchao Li, Liangrui Peng, Junyang Cai, Xiaoqing Ding, and Shuangkui Ge
Deep Strip-Based Network with Cascade Learning for Scene Text Localization .................................................826
   Dao Wu, Rui Wang, Pengwen Dai, Yueying Zhang, and Xiaochnuo Cao
Scene Text Eraser .............................................................................................................................................832
   Toshiki Nakamura, Anna Zhu, Keiji Yanai, and Seiichi Uchida
New Fuzzy-Mass Based Features for Video Image Type Categorization ................................................................838
   Sangheeta Roy, Palaihanakote Shivakumara, Namita Jain, Vijeta Khare, Umapada Pal, and Tong Lu
Attention-Based Extraction of Structured Information from Street View Imagery ..............................................844
   Zbigniew Wojna, Alexander N. Gorban, Dar-Shyang Lee, Kevin Murphy, Qian Yu, Yeqing Li, and Julian Ibarz
Text Detection in Traffic Informatory Signs Using Synthetic Data ......................................................................851
   Fangge Chen, Hirokatsu Kataoka, and Yutaka Satoh
Semantic Text Detection in Born-Digital Images via Fully Convolutional Networks ................................................859
   Nibal Nayef and Jean-Marc Ogier
Robust Document Image Dewarping Method Using Text-Lines and Line Segments ..............................................865
   Taeho Kil, Wonkyo Seo, Hyung Il Koo, and Nam Ik Cho
Oral Session 9: Online Handwriting Recognition

Design of a Very Compact CNN Classifier for Online Handwritten Chinese Character Recognition Using DropWeight and Global Pooling .................................................................891
Xuefeng Xiao, Yafeng Yang, Tasweer Ahmad, Lianwen Jin, and Tianhai Chang

Speedup of Parsing for Recognition of Online Handwritten Mathematical Expressions ..................................................................................................................896
Anh Duc Le and Masaki Nakagawa

A GRU-Based Encoder-Decoder Approach with Attention for Online Handwritten Mathematical Expression Recognition ..............................................................902
Jianshu Zhang, Jun Du, and Lirong Dai

AirScript - Creating Documents in Air .........................................................................908
Ayushman Dash, Amit Sahu, Rajveer Shringi, John Gamboa,
Muhammad Zeshan Afzal, Muhammad Imran Malik, Andreas Dengel,
and Sheraz Ahmed

Tree-Based BLSTM for Mathematical Expression Recognition ........................................914
Ting Zhang, Harold Mouchere, and Christian Viard-Gaudin

Oral Session 10: Scene Text Understanding

Improved Localization Accuracy by LocNet for Faster R-CNN Based Text Detection .................................................................923
Zhuoyao Zhong, Lei Sun, and Qiang Huo

Scene Text Detection with Novel Superpixel Based Character Candidate Extraction ..................................................................................................................929
Cong Wang, Fei Yin, and Cheng-Lin Liu

Total-Text: A Comprehensive Dataset for Scene Text Detection and Recognition ........................................................................................................935
Chee Kheng Ch'ng and Chee Seng Chan

Visual Attention Models for Scene Text Recognition .........................................................943
Suman K. Ghosh, Ernest Valveny, and Andrew D. Bagdanov

Text Detection Based on MSER and CNN Features ...........................................................................949
Houssem Turki, Mohamed Ben Halima, and Adel M. Alimi
Oral Session 11: Historic Document Image Analysis

Geographic and Style Models for Historical Map Alignment and Toponym Recognition ................................................................. 957

Jerod Weinman

Convolutional Neural Networks for Page Segmentation of Historical Document Images ........................................................................ 965

Kai Chen, Mathias Seuret, Jean Hennebert, and Rolf Ingold

Assisted Transcription of Historical Documents by Keyword Spotting: A Performance Model .......................................................... 971

Adolfo Santoro, Claudio De Stefano, and Angelo Marcelli

1990 US Census Form Recognition Using CTC Network, WFST Language Model, and Surname Correction ........................................... 977

Huaigu Cao, Stephen Rawls, and Prem Natarajan

Oral Session 12: Font, Writer, and Style Classification

Convolutional Neural Networks for Font Classification ...................................................................................................................... 985

Chris Tensmeyer, Daniel Saunders, and Tony Martinez

Unsupervised Feature Learning for Writer Identification and Writer Retrieval .................................................................................. 991

Vincent Christlein, Martin Gropp, Stefan Fiel, and Andreas Maier

Handwriting Style Mixture Adaptation .................................................................................................................................................. 998

Hong-Ming Yang, Xu-Yao Zhang, Fei Yin, and Cheng-Lin Liu

How Does a CNN Manage Different Printing Types? ......................................................................................................................... 1004

Shota Ide and Seiichi Uchida

Poster Session 3

Normalised Local Naïve Bayes Nearest-Neighbour Classifier for Offline Writer Identification ........................................................................................................... 1013

Hussein Mohammed, Volker Mäergner, Thomas Konidaris, and H. Siegfried Stiehl

The Character Generation in Handwriting Feature Extraction Using Variational AutoEncoder ........................................................................................................................................... 1019

Tomoki Yamada, Mariko Hosoe, Kunihito Kato, and Kazuhiko Yamamoto

A Comparative Study on Optical Modeling Units for Off-Line Arabic Text Recognition .................................................................................. 1025

Mohammed Faouzi BenZeghiba

Residual Recurrent Neural Network with Sparse Training for Offline Arabic Handwriting Recognition ......................................................................... 1031

Ruijie Yan, Liangrui Peng, GuangXiang Bin, Shengjin Wang, and Yao Cheng
Handwriting Recognition by Attribute Embedding and Recurrent Neural Networks ..................................................1038
  J. Ignacio Toledo, Sounak Dey, Alicia Fornés, and Josep Lladós

Subspace-Based Convolutional Network for Handwritten Character Recognition ..........................................................1044
  Bernardo Benthes Gatto, Eulanda Miranda dos Santos, and Kazuhiro Fukui

Scan, Attend and Read: End-to-End Handwritten Paragraph Recognition with MDLSTM Attention ..........................................................1050
  Théodore Bluche, Jérôme Louradour, and Ronaldo Messina

Training an End-to-End System for Handwritten Mathematical Expression Recognition by Generated Patterns ........................................1056
  Anh Duc Le and Masaki Nakagawa

GMU: A Novel RNN Neuron and Its Application to Handwriting Recognition ..........................................................1062
  Li Sun, Tonghua Su, Shengjie Zhou, and Lijun Yu

A Compact CNN-DBLSTM Based Character Model for Online Handwritten Chinese Text Recognition ..........................................................1068
  Kai Chen, Li Tian, Haisong Ding, Meng Cai, Lei Sun, Sen Liang, and Qiang Huo

A Faster R-CNN Based Method for Comic Characters Face Detection ................................................................................1074
  Xiaoran Qin, Yafeng Zhou, Zheqi He, Yongtao Wang, and Zhi Tang

Handwritten Music Recognition for Mensural Notation: Formulation, Data and Baseline Results ..............................................1081
  Jorge Calvo-Zaragoza, Alejandro H. Toselli, and Enrique Vidal

PhyloParser: A Hybrid Algorithm for Extracting Phylogenies from Dendrograms ........................................................................1087
  Po-shen Lee, Sean T. Yang, Jevin D. West, and Bill Howe

Auto-Encoder Guided GAN for Chinese Calligraphy Synthesis ................................................................................1095
  Pengyuan Lyu, Xiang Bai, Cong Yao, Zhen Zhu, Tengteng Huang, and Wenyu Liu

Beyond OCRs for Document Blur Estimation ................................................................................1101
  Pranjal Kumar Rai, Sajal Maheshwari, Ishit Mehta, Parikshit Sakurikar, and Vineet Gandhi

Improved Thresholding Method for Enhancing Jawi Binarization Performance ..........................................................1108
  Khairun Saddami, Khairul Munadi, Sayed Muchallil, and Fitri Arnia

Fourier-Residual for Printer Identification ................................................................................1114
  Zhen Wang, Palaiahnakote Shivakumara, Tong Lu, Mahadevappa Basavanna, Uma Pala, and Michael Blumenstein

Rank-Reducing Two-Dimensional Grammars for Document Layout Analysis ..........................................................1120
  Daniel Průša and Akio Fujiyoshi
Recovering Western On-Line Signatures from Image-Based Specimens ........................................1204

Moises Diaz, Miguel A. Ferrer, Antonio Parziale, and Angelo Marcelli

A Vector Quantization Based Feature Descriptor for Online Signature Verification ..........................................................1210

Vivek Venugopal, Abhishek Sharma, Rishabh Singh, Abhinav Sharma, and Suresh Sundaram

A Structural Approach to Offline Signature Verification Using Graph Edit Distance ............................................................1216

Paul Maergner, Kaspar Riesen, Rolf Ingold, and Andreas Fischer

Local Binary Patterns for Document Forgery Detection ..........................................................1223

Francisco Cruz, Nicolas Sidère, Mickaël Coustaty, Vincent Poulain D'Andecy, and Jean-Marc Ogier

Towards Automated Ink Mismatch Detection in Hyperspectral Document Images ......................................................................1229

Asad Abbas, Khurram Khurshid, and Faisal Shafait

Evaluation of Texture Descriptors for Validation of Counterfeit Documents ..........................................................1237

Albert Berenguel Centeno, Oriol Ramos Terrades, Josep Lladós i Canet, and Cristina Cañero Morales

On the Usage of I-Vector Representation for Online Handwritten Signature Verification ..........................................................1243

Hossein Zeinali and Bagher BabaAli

A Robust Symmetry-Based Method for Scene/Video Text Detection through Neural Network ..........................................................1249

Yirui Wu, Wenhai Wang, Shivakumara Palaiahnakote, and Tong Lu

End-to-End Scene Text Recognition in Videos Based on Multi Frame Tracking ..........................................................1255

Xiaobing Wang, Yingying Jiang, Shuli Yang, Xiangyu Zhu, Wei Li, Pei Fu, Hua Wang, and Zhenbo Luo

Real-Time Text Localization in Natural Scene Images Using a Linear Spatial Filter ..........................................................1261

Xavier Gironés and Carme Julià

Capturing Handwritten Ink Strokes with a Fast Video Camera ..........................................................1269

Chelhwon Kim, Patrick Chiu, and Hideto Oda

Cascaded Segmentation-Detection Networks for Word-Level Text Spotting ..........................................................1275

Siyang Qin and Roberto Manduchi

Color Stability and Homogeneity Regions to Detect Text in Real Scene Images: CSHR ..........................................................1283

Houda Gaddour, Slim Kanoun, and Nicole Vincent

Scene Text Relocation with Guidance ..........................................................1289

Anna Zhu and Seiichi Uchida

xx
Max-Pooling Based Scene Text Proposal for Scene Text Detection ..................................................1295

Dinh Nguyen Van, Shijian Lu, Xiang Bai, Nizar Ouarti, and Mounir Mokhtari

Grayscale-Projection Based Optimal Character Segmentation for Camera-Captured Faint Text Recognition ..................................................................................................................1301

Fuxi Jia, Cunzhao Shi, Yanna Wang, Chunheng Wang, and Baihua Xiao

Learning a Fast Bipartite Ranker for Text Documents Using Lexicographical Rankers and ROC Curves ........................................................................................................................................1307

Lucas de Souza Rodrigues, Edson Takashi Matsubara, and Bruno Magalhães Nogueira

A Multi-Label Neural Network Approach to Solving Connected CAPTCHAs ..........................................................1313

Ke Qing and Rong Zhang

Real-Time Document Image Classification Using Deep CNN and Extreme Learning Machines ........................................................................................................................................1318

Andreas Kölsch, Muhammad Zeshan Afzal, Markus Ebbecke, and Marcus Liwicki

A Man-Machine Cooperating System Based on the Generalized Reject Model ..........................................................1324

Shunichi Kimura, Eiichi Tanaka, Masanori Sekino, Takuya Sakurai, Satoshi Kubota, Ikken So, and Yutaka Koshi

Wearable Handwriting Recognition with an Inertial Sensor on a Finger Nail ..........................................................1330

Lei Jing, Zeyang Dai, and Yiming Zhou

Automatic Assignment of Topical Icons to Documents for Faster File Navigation ........................................................................................................................................1338

Rishiraj Saha Roy, Abhijeet Singh, Prashant Chawla, Shubham Saxena, and Atanu R. Sinha

Identification of Reader Specific Difficult Words by Analyzing Eye Gaze and Document Content ........................................................................................................................................1346

Utpal Garain, Onkar Pandit, Olivier Augereau, Ayano Okoso, and Koichi Kise

Competitions

cBAD: ICDAR2017 Competition on Baseline Detection ..........................................................................................1355

Markus Diem, Florian Kleber, Stefan Fiel, Tobias Grüning, and Basilis Gatos

ICDAR2017 Competition on Layout Analysis for Challenging Medieval Manuscripts ..........................................................1361

Fotini Simistira, Manuel Bouillon, Mathias Seuret, Marcel Würsch, Michele Alberti, Rolf Ingold, and Marcus Liwicki

ICDAR2017 Competition on the Classification of Medieval Handwritings in Latin Script ..........................................................1371

Florence Cloppet, Véronique Eglin, Marlène Helias-Baron, Cuong Kieu, Nicole Vincent, and Dominique Stutzmann
ICDAR2017 Competition on Historical Document Writer Identification  
(Historical-WI) ..........................................................................................................................1377

  Stefan Fiel, Florian Kleber, Markus Diem, Vincent Christlein,  
  Georgios Louloudis, Stamatopoulos Nikos, and Basilis Gatos

ICDAR2017 Competition on Handwritten Text Recognition on the READ  
Dataset .......................................................................................................................................1383

  Joan Andreu Sánchez, Verónica Romero, Alejandro H. Toselli,  
  Mauricio Villegas, and Enrique Vidal

ICDAR2017 Competition on Information Extraction in Historical Handwritten  
Records ......................................................................................................................................1389

  Alicia Fornés, Verónica Romero, Arnau Baró, Juan Ignacio Toledo,  
  Joan Andreu Sánchez, Enrique Vidal, and Josep Lladós

ICDAR2017 Competition on Document Image Binarization (DIBCO 2017) .........................1395

  Ioannis Pratikakis, Konstantinos Zagoris, George Barlas, and Basilis Gatos

ICDAR2017 Competition on Recognition of Documents with Complex Layouts  
- RDCL2017 ..........................................................................................................................1404

  Christian Clausner, Apostolos Antonacopoulos, and Stefan Pletschacher

ICDAR2017 Competition on Recognition of Early Indian Printed Documents -  
REID2017 .................................................................................................................................1411

  Christian Clausner, Apostolos Antonacopoulos, Tom Derrick,  
  and Stefan Pletschacher

ICDAR2017 Competition on Page Object Detection .................................................................1417

  Liangcai Gao, Xiaohan Yi, Zhuoren Jiang, Leipeng Hao, and Zhi Tang

ICDAR2017 Competition on Post-OCR Text Correction ..........................................................1423

  Guillaume Chiron, Antoine Doucet, Mickaël Coustaty, and Jean-Philippe Moreux

ICDAR2017 Competition on Reading Chinese Text in the Wild (RCTW-17) .........................1429

  Baoguang Shi, Cong Yao, Minghui Liao, Mingkun Yang, Pei Xu, Linyan Cui,  
  Serge Belongie, Shijian Lu, and Xiang Bai

ICDAR2017 Robust Reading Challenge on COCO-Text ..........................................................1435

  Raul Gomez, Baoguang Shi, Lluis Gomez, Lukas Numann, Andreas Veit,  
  Jiri Matas, Serge Belongie, and Dimosthenis Karatzas

ICDAR2017 Robust Reading Challenge on Text Extraction from Biomedical  
Literature Figures (DeTEXT) .....................................................................................................1444

  Chun Yang, Xu-Cheng Yin, Hong Yu, Dimosthenis Karatzas, and Yu Cao

ICDAR2017 Robust Reading Challenge on Omnidirectional Video ........................................1448

  Masakazu Iwamura, Naoyuki Morimoto, Keishi Tainaka, Dena Bazazian,  
  Lluis Gomez, and Dimosthenis Karatzas
ICDAR2017 Robust Reading Challenge on Multi-Lingual Scene Text Detection
and Script Identification - RRC-MLT .................................................................1454

  Nibal Nayef, Fei Yin, Imen Bizid, Hyunsoo Choi, Yuan Feng,
  Dimosthenis Karatzas, Zhenbo Luo, Umapada Pal, Christophe Rigaud,
  Joseph Chazalon, Wafa Khliif, Muhammad Muzzamil Luqman,
  Jean-Christophe Burie, Cheng-lin Liu, and Jean-Marc Ogier

ICDAR2017 Competition on Arabic Text Detection and Recognition
in Multi-Resolution Video Frames ........................................................................1460

  Oussama Zayene, Jean Hennebert, Rolf Ingold, and Najoua Essoukri BenAmara

ICDAR2017 Competition on Multi-Font and Multi-Size Digitally Represented
Arabic Text .............................................................................................................1466

  Fouad Slimane, Rolf Ingold, and Jean Hennebert

Author Index - Volume 1
2017 14th IAPR International Conference on Document Analysis and Recognition (ICDAR 2017)

Kyoto, Japan
9-15 November 2017

Volume 2
Pages 1-57
2017 14th IAPR International Conference on Document Analysis and Recognition

ICDAR 2017

Table of Contents

Volume - 2

GREC 2017 Welcome Message - Volume 2........................................................................................................viii
GREC 2017 Steering Committee - Volume 2....................................................................................................ix
GREC 2017 Program Committee - Volume 2...................................................................................................x

GREC: 12th International Workshop on Graphics Recognition

Extraction of Ancient Map Contents Using Trees of Connected Components .............................................3
   Jordan Drapeau, Thierry Géraud, Mickael Coustaty, Joseph Chazalon,
   Jean-Christophe Burie, Véronique Eglin, and Stéphane Bres

Interpreting Data from Scanned Tables ........................................................................................................5
   Waleed Farrukh, Antonio Foncubierta-Rodriguez, Anca-Nicoleta Ciubotaru,
   Guillaume Jaume, Costas Bejas, Orcun Goksel, and Maria Gabrani

An Efficient Combinatorial Algorithm for Optimal Compression of a Polyline with Segments and Arcs ..........................................................7
   Alexander Gribov

Automatic Orientation Correction of AEC Drawing Documents .................................................................9
   Bhagesh Seraogi, Supriya Das, Purnendu Banerjee, Himadri Majumdar,
   Srinivas Mukkamala, Rahul Roy, and Bidyut B. Chaudhuri

Extracting Interactions from Molecular Pathways ...................................................................................11
   Antonio Foncubierta-Rodriguez, Anca-Nicoleta Ciubotaru, Costas Bekas,
   and Maria Gabrani

Searching for a Compressed Polyline with a Minimum Number of Vertices ...........................................13
   Alexander Gribov

Approximate Fitting a Circular Arc When Two Points Are Known .........................................................15
   Alexander Gribov
2017 14th IAPR International Conference on Document Analysis and Recognition (ICDAR 2017)

Kyoto, Japan
9-15 November 2017

Volume 3
Pages 1-84
2017 14th IAPR International Conference on Document Analysis and Recognition
ICDAR 2017
Table of Contents
Volume - 3

Message from the MANPU 2017 Organizers -
Volume 3.................................................................................................................................vii
MANPU 2017 Organizers - Volume 3.....................................................................................viii

MANPU: 2nd International Workshop on coMics Analysis, Processing, and Understanding

Invited Talk
Introduction to Manga Box: Manga App Business and Engineering ........................................5
  Daiki Suzuki

MANPU Oral Session 1
Accessible Comics for Visually Impaired People: Challenges and Opportunities.............................9
  Frédéric Rayar
The Graphic Narrative Corpus (GNC): Design, Annotation, and Analysis for the Digital Humanities.........15
  Alexander Dunst, Rita Hartel, and Jochen Laubrock
Using Posters to Recommend Anime and Mangas in a Cold-Start Scenario........................................21
  Jill-Jênn Vie, Florian Yger, Ryan Lahfa, Basile Clement, Kévin Cocchi, Thomas Chalumeau, and Hisashi Kashima
MANPU Oral Session 2
Segmentation-Free Speech Text Recognition for Comic Books .................................................................29
Christophe Rigaud, Jean-Christophe Burie, and Jean-Marc Ogier

Into the Colorful World of Webtoons: Through the Lens of Neural Networks ........................................35
Ceyda Cinarel and Byoung-Tak Zhang

Comic Characters Detection Using Deep Learning .........................................................................................41
Nhu-Van Nguyen, Christophe Rigaud, and Jean-Christophe Burie

MANPU Poster Session
Sketch-Based Manga Retrieval Using Deep Features ..................................................................................49
Rei Narita, Koki Tsubota, Toshihiko Yamasaki, and Kiyoharu Aizawa

An Overview of Comics Research in Computer Science .............................................................................54
Olivier Augereau, Motoi Iwata, and Koichi Kise

Comic Story Analysis Based on Genre Classification .................................................................................60
Yuki Daiku, Olivier Augereau, Motoi Iwata, and Koichi Kise

Histogram of Exclamation Marks and Its Application for Comics Analysis .............................................66
Sotaro Hiroe and Seiji Hotta

cGAN-Based Manga Colorization Using a Single Training Image .............................................................72
Paulina Hensman and Kiyoharu Aizawa

Story Pattern Analysis Based on Scene Order Information in Four-Scene Comics .....................................78
Miki Ueno and Hitoshi Isahara

Author Index - Volume 3 ..........................................................................................................................84
2017 14th IAPR International Conference on Document Analysis and Recognition (ICDAR 2017)

Kyoto, Japan
9-15 November 2017

Volume 4
Pages 1-53
Welcome Message from the ICDAR-OST 2017
Organizers - Volume 4 .............................................................................................................vii
ICDAR-OST 2017 Organizers - Volume 4 .............................................................................viii

ICDAR-OST: 1st International Workshop on Open Services and Tools for Document Analysis

ICDAR-OST First Interactive Pitch & Demo Session
PyStruct Extension for Typed CRF Graphs ..................................................................................5
  Jean-Luc Meunier
SmartDoc 2017 Video Capture: Mobile Document Acquisition in Video Mode .....................11
  J. Chazalon, P. Gomez-Krämer, J.-C. Burie, M. Coustaty, S. Eskenazi,
  M. Luqman, N. Nayef, M. Rusiñol, N. Sidère, and J.-M. Ogier

ICDAR-OST Second Interactive Pitch & Demo Session
Transkribus - A Service Platform for Transcription, Recognition and Retrieval of Historical Documents ..................................................................................................................19
  Philip Kahle, Sebastian Colutto, Günter Hackl, and Günter Mühberger
  Rohit Saluja, Devaraj Adiga, Ganesh Ramakrishnan, Parag Chaudhuri,
  and Mark Carman
DAE-NG: A Shareable and Open Document Image Annotation Data Framework .........................31
  Bart Lamiroy
   Soumyadeep Dey, Barsha Mitra, Jayanta Mukhopadhyay, and Shamik Sural

ICDAR-OST Third Interactive Pitch & Demo Session

Open Evaluation Tool for Layout Analysis of Document Images .......................................................43
   Michele Alberti, Manuel Bouillon, Rolf Ingold, and Marcus Liwicki

Turning Document Image Analysis Methods into Web Services - An Example
Using OCRopus ………………………………………………………………………………………………….48
   Marcel Würsch, Foteini Simistira, Rolf Ingold, and Marcus Liwicki

Author Index - Volume 4 ........................................................................................................................53
Message from the ICDAR-WML 2017

Workshop Chairs and Program Chairs -

ICDAR-WML 2017 Organizing Committee -

ICDAR-WML: First Workshop of Machine Learning under International Conference on Document Analysis and Recognition

ICDAR-WML Session 1

Handwritten Text Line Segmentation Using Fully Convolutional Network .........................................................5
  Guillaume Renton, Clement Chatelain, Sebastien Adam,
  Christopher Kermorvant, and Thierry Paquet

Multilevel Context Representation for Improving Object Recognition .............................................................10
  Andreas Kölsch, Muhammad Zeshan Afzal, and Marcus Liwicki

Semantic Text Encoding for Text Classification Using Convolutional Neural Networks ......................................16
  Ignazio Gallo, Shah Nawaz, and Alessandro Calefati
ICDAR-WML Session 2

Combination of ResNet and Center Loss Based Metric Learning for Handwritten Chinese Character Recognition ..........................................................25
  Ruyu Zhang, Qingqing Wang, and Yue Lu

Exploiting State-of-the-Art Deep Learning Methods for Document Image Analysis .................................................................................................30
  Vinaychandran Pondenkandath, Mathias Seuret, Rolf Ingold, Muhammad Zeshan Afzal, and Marcus Liwicki

Multimodal Classification Fusion in Real-World Scenarios ..........................................................36
  Ignazio Gallo, Alessandro Calefati, and Shah Nawaz

ICDAR-WML Session 3

Orthographic Properties Based Telugu Text Recognition Using Hidden Markov Models ..........................................................45
  Devarapalli Koteswara Rao and Atul Negi

Neural Font Style Transfer .............................................................................................................51
  Gantugs Atarsaikhan, Brian Kenji Iwana, Atsushi Narusawa, Keiji Yanai, and Seiichi Uchida

New Word Pair Level Embeddings to Improve Word Pair Similarity ............................................57
  Nazar Khan and Asma Shaukat

ICDAR-WML Session 4

Text Independent Writer Identification for Telugu Script Using Directional Filter Based Features ..................................................................................65
  Chris Andrew Gadde, Santhoshini Reddy, Viswanath Pulabaigari, and Umnapda Pal

A Novel Feature Ranking Criterion for Supervised Interval Valued Feature Selection for Classification ..........................................................71
  N. Vinay Kumar and D.S. Guru

Machine Learning vs Deterministic Rule-Based System for Document Stream Segmentation .....................................................................................77
  Ahmed Hamdi, Joris Voerman, Mickaël Coustaty, Aurelie Joseph, Vincent Poualain d'Andecy, and Jean-Marc Ogier

Author Index - Volume 5 ..............................................................................................................83
2017 14th IAPR International Conference on Document Analysis and Recognition

ICDAR 2017

Table of Contents
Volume - 6

Welcome Message from the CBDAR 2017
Organizers - Volume 6
CBDAR 2017 Organizing Committee - Volume 6

CBDAR: 7th International Workshop on Camera-Based Document Analysis and Recognition

Feature Pyramid Based Scene Text Detector
MengYi En, Rong Li, JianQiang Li, and Bo Liu

Guiding Text Image Keypoints Extraction through Layout Analysis
Emilien Royer and Frédéric Bouchara

Text Detection by Faster R-CNN with Multiple Region Proposal Networks
Yoshito Nagaoka, Tomo Miyazaki, Yoshihiro Sugaya, and Shinichiro Omachi

Click-Free, Video-Based Document Capture - Methodology and Evaluation
Waqas Tariq Dar and Muhammad Nazar Amin Khan

Robust Perspective Rectification of Camera-Captured Document Images
Yusuke Takezawa, Makoto Hasegawa, and Salvatore Tabbone

Information Extraction from Hand-Marked Industrial Inspection Sheets
Gaurav Gupta, Swati, Monika Sharma, and Lovekesh Vig

Smart IDReader: Document Recognition in Video Stream
Konstantin Bulatov, Vladimir V. Arlazarov, Timofey Chemov, Oleg Slavin, and Dmitry Nikolaev
Message from the MOCR 2017 General Chairs - Volume 7 .......................... vii
MOCR 2017 Organizing Committee - Volume 7 .................................................. viii

MOCR: 6th International Workshop on Multilingual OCR

**MOCR Session 1**

- Deep Convolutional Recurrent Network for Segmentation-Free Offline Handwritten Japanese Text Recognition ......................................................... 5
  - Nam-Tuan Ly, Cuong-Tuan Nguyen, Kha-Cong Nguyen, and Masaki Nakagawa

- KHATT: A Deep Learning Benchmark on Arabic Script .................................. 10
  - Riaz Ahmad, Saeeda Naz, M. Zeshan Afzal, S. Faisal Rashid, Marcus Liwicki, and Andreas Dengel

- The Impact of Visual Similarities of Arabic-Like Scripts Regarding Learning in an OCR System .............................................................. 15
  - Riaz Ahmad, Saeeda Naz, M. Zeshan Afzal, S. Faisal Rashid, Marcus Liwicki, and Andreas Dengel

- Detection and Recognition of Arabic Text in Video Frames .......................... 20
  - Wataru Ohyama, Seiya Iwata, Tetsushi Wakabayashi, and Fumitaka Kimura
MOCR Session 2

Implicit Language Model in LSTM for OCR .................................................................27
   Ekraam Sabir, Stephen Rawls, and Prem Natarajan

An Empirical Study of Effectiveness of Post-Processing in Indic Scripts ....................32
   V.S. Vinitha, Minesh Mathew, and C.V. Jawahar

Improving Classical OCRs for Brahmic Scripts Using Script Grammar Learning ..........37
   Dipankar Ganguly, Sumeet Agarwal, and Santanu Chaudhury

Benchmarking Scene Text Recognition in Devanagari, Telugu and Malayalam ..........42
   Minesh Mathew, Mohit Jain, and C.V. Jawahar

Author Index - Volume 7 ..............................................................................................47
Message from the HDI 2017 Organizers -
Volume 8 .......................................................................................................................................vii
HDI 2017 Organizers - Volume 8 ...........................................................................................................viii

HDI: 1st International Workshop on Human-Document Interaction

HDI Oral Session 1
Human-Assisted Signature Recognition Based on Comparative Attributes ........................................5
  Derlin Morocho, Aythami Morales, Julian Fierrez, and Ruben Vera-Rodriguez
On-the-fly Historical Handwritten Text Annotation .............................................................................10
  Ekta Vats and Anders Hast
Exploring Old Maps by Finger Tracing of Characters ........................................................................15
  Yuichi Watanabe, Kengo Terasawa, and Yasuyuki Sumi

HDI Oral Session 2
Landscape or Portrait? The Impact of Page Orientation on the Understandability of Scientific Posters ........................................23
  Marc Beck, Seyyed Saleh Mozaffari Chanjani, Syed Saqib Bukhari, and Andreas Dengel
Using the Eye Gaze to Predict Document Reading Subjective Understanding ................................28
  Charles Lima Sanches, Olivier Augereau, and Koichi Kise
# ICDAR 2017

## Table of Contents

**Volume - 9**

<table>
<thead>
<tr>
<th>Message from the IWCDF 2017 Organizers -</th>
<th>vi</th>
</tr>
</thead>
<tbody>
<tr>
<td>IWCDF 2017 Organizing Committee - Volume 9</td>
<td>vii</td>
</tr>
<tr>
<td>IWCDF 2017 Reviewers - Volume 9</td>
<td>viii</td>
</tr>
</tbody>
</table>

**IWCDF: 1st International Workshop on Computational Document Forensics**

- A Study of the Factors Influencing OCR Stability for Hybrid Security
  
  Sébastien Eskenazi, Petra Gomez-Krämer, and Jean-Marc Ogier
  
  Page: 3

- A Case Study of the Relationship between Local Pen Action and Three Dimensional Shapes of Handwritten Strokes
  
  Yoshinori Akao and Yoshiyasu Higashikawa
  
  Page: 9

  
  Albert Berenguel Centeno, Oriol Ramos Terrades, Josep Lladós i Canet, and Cristina Cañero Morales
  
  Page: 15

- A Spatial Domain Steganography for Grayscale Documents Using Pattern Recognition Techniques
  
  Jean-Christophe Burie, Jean-Marc Ogier, and Cu Vinh Loc
  
  Page: 21

- Robustness of Character Recognition Techniques to Double Print-and-Scan Process
  
  Iuliia Tkachenko and Petra Gomez-Krämer
  
  Page: 27

| Author Index - Volume 9 | 33 |