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Document Understanding - 1996

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Abstract

This report contains nearly 340 references which are directly related to the field of document image understanding and appeared in major journals and conferences during 1996. Each reference is classified by major topic. Areas covered include, but are not limited to, preprocessing, models and representations, on-line recognition, off-line recognition, graphics recognition and interpretation, page processing, post-processing and special applications.

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Document Understanding Bibliography



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March 28, 1997

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1 Introduction

This document contains information about **DOCBIB**, a Document Understanding Bibliography which has been available on-line from the University of Maryland since the Fall of 1993.

The complete bibliography contains selected references from before 1980, major references for the 1980's and a more complete set of references for 1990 and beyond. References are included for topics such as preprocessing, representation, on- and off-line recognition, graphics interpretation, page analysis, and signature verification, among others.

The bibliography is not intended to be comprehensive of all document understanding literature, but rather is a resource which can be used to obtain entry points into the document literature. The current bibliography is skewed toward document image understanding, with some on-line recognition references. The bibliography is updated periodically as new sources emerge or as additional topics are added by interested parties.

This report contains only entries for the calendar year 1996; additional entries for previous years are available online. Each entry appears only once in its major category. Although a given category may be blank, there may be relevant entries listed in other categories. Users are encouraged to make use of the on-line search capabilities to obtain a more comprehensive list.

SPECIAL NOTE: In the online version of this document, many of the categories have changed and several were added for 1996. Unfortunately, they have not yet filtered back through previous years. For example, Word Segmentation, Enhancement, and Retrieval were added, but references from previous years may still fall in other categories. The category classification is not intended to be comprehensive, but rather representative. The best way to search the literature is on-line.

1.1 Sources

References have been gathered from a wide variety of sources, but are primarily from the computer vision and pattern recognition literature. The next two sections contain lists of primarily conference and journal sources, respectively.

1.1.1 Conference and Workshop Proceedings

<i>Abbreviation</i>	<i>Conference</i>	<i>Years</i>
CVPR	IEEE Computer Society Conference on Computer Vision and Pattern Recognition	1985-
DAS	Document Analysis Systems	
GREC	International Workshop on Graphics Recognition	
ICIP	International Conference on Image Processing	
ICPR	International Conference on Pattern Recognition	1984-
ICDAR	International Conference on Document Analysis and Recognition	1991-
IWFHR	International Workshop on Frontiers in Handwriting Recognition	1990-
SDIUT	Symposium on Document Image Understanding Technology	
SPIE	SPIE - Character Recognition and Document Analysis Meetings	
SSPR	Syntactic and Structural Pattern Recognition	
VF	Visual Form	

1.1.2 Journals

<i>Abbreviation</i>	<i>Journal</i>	<i>Years</i>
AI	Artificial Intelligence	1987
BC	Biological Cybernetics	1990-
CGIP	Computer Graphics and Image Processing	
COMPUTER	IEEE Computer	
CVGIP	Computer Vision, Graphics and Image Processing	1984-
CVIP	Computer Vision and Image Processing	1992-
CVIU	Computer Vision and Image Understanding	
GMIP	Graphical Models and Image Processing (CVGIP)	1992-
IBMJRD	IBM Journal of Research and Development	
IBMSYS	IBM Systems Journal	
IJCV	International Journal of Computer Vision	
IJPRAI	International Journal of Pattern Recognition and Artificial Intelligence	
IPL	Information Processing Letters	
IU	Image Understanding (CVGIP)	1992-
IVC	Image and Vision Computing	
JVCIR	Journal of Visual Communication and Image Representation	
MVA	Machine Vision and Applications	
PIEEE	Proceedings of the IEEE	
PR	Pattern Recognition	1983-
PRL	Pattern Recognition Letters	1983-
SP	Signal Processing	
TCOMP	IEEE Transactions on Computers	
TIP	IEEE Transactions on Image Processing	
TPAMI	IEEE Transactions on Pattern Analysis and Machine Intelligence	
TSMC	IEEE Transactions on Systems, Man, and Cybernetics	
TSE	IEEE Transactions on Software Engineering	
VC	The Visual Computer	

1.2 Organization of Bibliography

This bibliography is stored in BIBTEX format, with all of the standard fields and an additional “CATEGORY” field which contains a broad categorization of the article into the hierarchy presented below.

Not all references fit cleanly into a single category. The hardcopy version of the bibliography places each reference into the *most appropriate* primary category¹. Secondary keywords are appended to provide a more specific categorization of the topic described or the approach taken in the work.

Please note:

- As a general rule, a topic or category area will be given its own section when it contains 10 references which do not fit cleanly into another category.
- No hyphans are used in any of the keywords.
- The category “GENERAL” is used as a way of extracting references other then the ones in the other subsections.

1.2.1 Hierarchy

	<u>CATEGORY</u>
I Books	1 [BOOK,*]
II Meetings	2 [MEETING,*]
III Special Issues	3 [SPECIAL ISSUE,*]
IV Pre-processing Tasks	
Survey	4 [PREPROCESSING,SURVEY]
Character Segmentation	5 [PREPROCESSING,CHARACTER SEGMENTATION]
Word Segmentation	6 [PREPROCESSING,WORD SEGMENTATION]
Feature Extraction	7 [PREPROCESSING,FEATURE EXTRACTION]
Skew Detection	8 [PREPROCESSING,SKEW]
Text/Graphics Discrimination	9 [PREPROCESSING,TEXT GRAPHICS]
Thinning	10 [PREPROCESSING,THINNING]
Thresholding	11 [PREPROCESSING,THRESHOLDING]
Vectorization	12 [PREPROCESSING,VECTORIZATION]
Enhancement	13 [PREPROCESSING,ENHANCEMENT]
General References	14 [PREPROCESSING,*]
V Models, Analysis and Representations	
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Handwriting Models	16 [HANDWRITING MODELS]
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VI Text Processing	
On-line Recognition	
Surveys	19 [TEXT PROCESSING,ONLINE,SURVEY]
Foreign	20 [TEXT PROCESSING,ONLINE,FOREIGN LANGUAGE]
Gestures and Sketches	21 [TEXT PROCESSING,ONLINE,SKETCHES]
Script	22 [TEXT PROCESSING,ONLINE,HANDWRITTEN]
Word Recognition	23 [TEXT PROCESSING,ONLINE,WORD]
General References	24 [TEXT PROCESSING,ONLINE,*]
Optical Character Recognition - Latin	
Surveys	25 [TEXT PROCESSING,OCR,SURVEY]
Hand-Printed	26 [TEXT PROCESSING,OCR,HAND PRINTED]
Script	27 [TEXT PROCESSING,OCR,HANDWRITTEN]
Machine-Printed	28 [TEXT PROCESSING,OCR,MACHINE PRINTED]
Digit Recognition	29 [TEXT PROCESSING,OCR,DIGIT]
Word Recognition	30 [TEXT PROCESSING,OCR,WORD]
General References	31 [TEXT PROCESSING,OCR,*]
Optical Character Recognition - Foreign	
Chinese	32 [TEXT PROCESSING,OCR,FOREIGN LANGUAGE,CHINESE]
Japanese	33 [TEXT PROCESSING,OCR,FOREIGN LANGUAGE,JAPANESE]

¹ On-line access to DocBib is described in Section 1.5.2

Hebrew	34	[TEXT PROCESSING,OCR,FOREIGN LANGUAGE,HEBREW]
Arabic	35	[TEXT PROCESSING,OCR,FOREIGN LANGUAGE,ARABIC]
Other Languages	36	[TEXT PROCESSING,OCR,FOREIGN LANGUAGE,*]
General References	37	[TEXT PROCESSING,*]
VII Graphics Recognition and Interpretation		
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Maps	41	[GRAPHICS,MAPS]
Tables	42	[GRAPHICS,TABLES]
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VIII Page and Document Processing		
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General References	51	[DOCUMENT PROCESSING,PAGE SEGMENTATION,LOGICAL ANALYSIS]
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General References	56	[POSTPROCESSING,*]
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Fax Processing	58	[APPLICATION,FAX]
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Character Set Recognition	60	[APPLICATION,CHARACTER SET RECOGNITION]
Language Recognition	61	[APPLICATION,LANGUAGE RECOGNITION]
Logo Recognition	62	[APPLICATION,LOGO]
Postal Applications	63	[APPLICATION,POSTAL]
Signature Verification	64	[APPLICATION,SIGNATURE]
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Font Processing	72	[FONT]
Synthetic Data	73	[SYNTHETIC]
Databases	74	[DATABASES]
Music Recognition	75	[MUSIC]
Shorthand	76	[SHORTHAND]
Natural Scenes	77	[NATURE]
Information Retrieval	78	[INFORMATION RETRIEVAL]
Machine Translation	79	[MACHINE TRANSLATION]
Hardware	80	[HARDWARE]
XII Miscellaneous	81	[MISC]

1.2.2 Primary Category Descriptors

BOOK	Book
MEETING	Meeting
SPECIAL ISSUE	Special Issue
APPLICATIONS	
CHARACTER SEGMENTATION	
CHARACTER SET RECOGNITION	Alphabet Identification
CHECKS	Check Processing
COMPRESSION	
CONTEXT	Use of Context or Priors
DATABASES	for Training, Testing or Storage
DIGITAL LIBRARIES	
DOCUMENT MODELS	Page Level Modeling
DOCUMENT PROCESSING	
ENGINEERING DRAWING	Engineering Drawing Interpretation
ENHANCEMENT	
EVALUATION	Error Analysis and Evaluation
FAX	Fax Processing
FEATURE EXTRACTION	Feature Extraction
FOREIGN LANGUAGE	Foreign Language Processing
FORMS	Forms Processing
FORMULAS	Mathematics and Scientific Notation
GENERAL	General References of a Category
GRAPHICS	Graphics Understanding
HAND PRINTED	Hand-Produced Documents
HANDWRITING ANALYSIS	Handwriting Analysis
HANDWRITING MODELS	
HANDWRITTEN	Handwritten (Script) Recognition
HUMAN INTERACTION	
INFORMATION RETRIEVAL	
LANGUAGE RECOGNITION	
LINE DRAWING	
LOGICAL ANALYSIS	Logical Layout Analysis
LOGO	Logo and Seal Processing
MACHINE PRINTED	Machine-produced Documents
MACHINE TRANSLATION	
MAPS	Map Understanding
MUSIC	Music Processing
NATURE	Documents in 3D Scenes
NATURE LANGUAGE	Documents in 3D Scenes
OCR	Optical Character Recognition
ONLINE	On-line Recognition
PAGE CLASSIFICATION	
PAGE SEGMENTATION	
POSTAL	Mail-piece Processing
POSTPROCESSING	
PREPROCESSING	
RETRIEVAL	Retrieval of Document Images
REPRESENTATION	

SHORTHAND	Shorthand Processing
SIGNATURE	Signature Verification
SKETCHES	Hand-produced Graphics
SKEW	Skew Detection and Correction
SPECIAL APPLICATIONS	
SURVEY	Survey Papers
SYNTHETIC	
TABLES	Table Processing, Flowcharts
TEXT PROCESSING	
TEXT GRAPHICS	Text/Graphics Discrimination
THINNING	Thinning Algorithms
THRESHOLDING	Thresholding Algorithms
WORD	Whole Word Recognition
WORD SEGMENTATION	
WRITER IDENTIFICATION	
ZONE CLASSIFICATION	

1.2.3 Additional Category Descriptors

General Descriptors

ADDRESS	Address Block Location
COLOR	Processing of Color in Documents
COMPRESSION	Compression and Vectorization
DIGIT	Numeric Digits
FONT	Font Processing
GRAYSCALE	
HARDWARE	Hardware
HOUGH	Hough Transform
MARKOV	Markov Models
MORPHOLOGY	
NGRAM	N-Gram Probabilities
OFFLINE	
PARALLEL	Parallel Algorithms
SYSTEM	Systems
VECTORIZATION	
ZIP CODE	Zip Code Processing

Classifier/Pattern Recognition Descriptors

CLASSIFIER	Classification
CLUSTERING	Clustering Approach
FUZZY LOGIC	
KNOWLEDGE BASED	Expert Systems
LEARNING	Learning-based Approaches
NEURAL NET	Neural Nets
RELAXATION	Relaxation
STATISTICAL	Statistical PR Approaches
STRUCTURAL	Structural Approaches
SYNTACTIC	Syntactic PR Approaches
TEMPLATE MATCHING	

Language Descriptors

ARABIC
CHINESE
CHITRA
CYRILLIC
DEVANAGARI
FARSI
GREEK
HEBREW
ITALIAN
JAPANESE KANJI
JAPANESE HIRAGANA
JAPANESE KATAKANA
KOREAN
MANDARIN
PINYIN
TAMIL
TELUGU

1.3 BIBTEX Conventions

- The bibtex-key is constructed by using the author's last name and the last two digits of the year. For multiple references by the same author or authors with the same first three letters of the last name, the letters 'a', 'b', ... are appended.

```
@inproceedings{kasturi88,
  AUTHOR = {R. Kasturi},
  BOOKTITLE = ICPR,
  PAGES = {255-259 },
  TITLE = {A System for Recognition and Description of Graphics },
  YEAR = 1988,
  CATEGORY = {DOC, TEXTGRAPH}
}

@article{kasturi88a,
  AUTHOR = {R. Kasturi and J. Alemany },
  JOURNAL = TSE,
  PAGES = {671-675},
  TITLE = {Information Extraction from Images of Paper-Based Maps },
  VOLUME = 14,
  YEAR = 1988,
  CATEGORY = {GRAPHICS, MAPS}
}
```

- All @STRING commands are kept in one file (DocumentStrings.bib). This file should be the first file in bibliography command.

1.4 Bibliography File

The bibliographies are provided in a compiled Postscript version organized by category, with contents, and an author index, and well as in a searchable database.

doc89.ps: contains the compiled reference list in a Postscript File

The 1990-present bibliographies are yearly.

A comprehensive bibliography is also available (.PS), but may differ slightly from older yearly collections because of changes in the organization.

1.5 Accessing DOCBIB

1.5.1 Off-Line

A copy of this document is available by sending a request to the Language and Media Processing Laboratory, Center for Automation Research, University of Maryland, College Park, MD 20742.

1.5.2 On-Line from the Document Information Server

Via WWW access

A search form is available via WWW at <http://documents.cfar.umd.edu>

Via anonymous FTP access

To access files in DOCBIB, internet users can use FTP (file-transfer-protocol) to copy files and programs to their machines. The bibliographies can be downloaded and searched using the *bibindex* and *biblook* utilities provided in the utilities directory from documents.cfar.umd.edu. See the file named README for more information about the contents of files.

In the following example, where much of the output from ftp is left out, the following conventions are used.

"\$" is your system's prompt

"ftp>" is the prompt from the file transfer program

```
$ ftp documents.cfar.umd.edu          to reach our archive; obscure text will follow
Name (...): anonymous                user logs in with standard anon ftp name
Password: yourname@yoursite         use your name and your site for identification
ftp> cd pub/DOCBIB                  go to DOC Bibliography directory
ftp> dir                             to get a listing of what's there
ftp> get README                     to retrieve a file
ftp> cd databases                   go to DOC Bibliography Database directory
ftp> get DocumentBib.ps             to retrieve the complete PS file
ftp> quit                            to leave ftp when done
```

1.6 Acknowledgements

We thank Professor Azriel Rosenfeld for the tens of thousands of vision references he has compiled over the years, of which document understanding is a small part. He has graciously allowed us to use the data and convert it for inclusion in our system.

Special thanks to Chris Vance for his many hours of editing references and writing utilities to automate the creation process and to Kevin Marsh for subsequent updates.

2 Books

- [1] R. Kasturi and K. Tombre, editors. *Graphics Recognition – Methods and Applications*. Springer, Berlin, Germany, 1996.
KEY: kasturi96
CATEGORIES: BOOK

3 Meetings

- [2] Workshop on Document Analysis Systems. Malvern, PA, USA, 10/14–16 1996.
KEY: das96
CATEGORIES: MEETING
- [3] Fourth French National Conference on Writing and Documents. Nantes, France, 7/3–5 1996.
KEY: fncwd96
CATEGORIES: MEETING
- [4] Fifth International Workshop on Frontiers in Handwriting Recognition. Colchester, UK, 9/2–5 1996.
KEY: iwfhr96
CATEGORIES: MEETING
- [5] Fifth Symposium on Document Analysis and Information Retrieval. Las Vegas, NV, USA, 4/15–17 1996.
KEY: sdair96
CATEGORIES: MEETING
- [6] SPIE - Document Recognition III. San Jose, CA, USA, 1/29–30 1996.
KEY: spie2660
CATEGORIES: MEETING

4 Special Issues

- [7] B. Schatz and H. Chen, editors. *Building Large-Scale Digital Libraries*, volume 29 of *IEEE Computer*. January, 1996.
KEY: computersi96
CATEGORIES: SPECIAL ISSUE
- [8] S.N. Srihari and D. Niyogi, editors. *Document Analysis and Recognition*, volume 7 of *IJIST*. Winter, 1996.
KEY: ijistsi96
CATEGORIES: SPECIAL ISSUE
- [9] S. Mori, editor. *Character Recognition and Document Understanding*, volume E79-D of *T-I&S*. May, 1996.
KEY: tissi96
CATEGORIES: SPECIAL ISSUE
- [10] S.S. Chen, editor. *Digital Libraries: Guest Editor's Introduction*, volume 7 of *VCIR*. March, 1996.
KEY: vcirsi96
CATEGORIES: SPECIAL ISSUE

5 Pre-processing Tasks

5.1 Survey

- [11] R. G. Casey and E. Lecolinet. A survey of methods and strategies in character segmentation. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 18(7):690–706, 1996.

KEY: casey96

CATEGORIES: PREPROCESSING, SURVEY, CHARACTER SEGMENTATION

- [12] Y. Lu and M. Shridhar. Character segmentation in handwritten words—an overview. *Pattern Recognition*, 29(1):77–96, 1996.

KEY: lu96

CATEGORIES: PREPROCESSING, SURVEY, CHARACTER SEGMENTATION, TEXT PROCESSING, OCR, HANDWRITTEN

- [13] D. Trier, A. K. Jain, and T. Taxt. Feature extraction methods for character recognition—a survey. *Pattern Recognition*, 29(4):641–662, 1996.

KEY: trier96

CATEGORIES: PREPROCESSING, SURVEY, FEATURE EXTRACTION

5.2 Character Segmentation

- [14] S. W. Lee and E. J. Lee. Integrated segmentation and recognition of connected handwritten characters with recurrent neural network. In *Proceedings of the SPIE - Document Recognition III*, pages 251–261, 1996.

KEY: lee96d

CATEGORIES: PREPROCESSING, CHARACTER SEGMENTATION, NEURAL NET

- [15] A. Ymin and Y. Aoki. On the segmentation of multi-font printed Uygur scripts. In *Proceedings of the International Conference on Pattern Recognition*, pages 215–219, 1996.

KEY: min96

CATEGORIES: PREPROCESSING, CHARACTER SEGMENTATION, TEXT PROCESSING, OCR, FOREIGN LANGUAGE

- [16] M. Okamoto, H. Yamamoto, K. Sawada, and K. Yamamoto. On-line handwriting character string separation method using network expression. In *Proceedings of the International Conference on Pattern Recognition*, pages 422–425, 1996.

KEY: okamoto96

CATEGORIES: PREPROCESSING, CHARACTER SEGMENTATION

5.3 Word Segmentation

- [17] S. W. Lee, D. J. Lee, and H. S. Park. A new methodology for gray-scale character segmentation and recognition. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 18(10):1045–1050, 1996.

KEY: lee96c

CATEGORIES: PREPROCESSING, WORD SEGMENTATION, TEXT PROCESSING, OCR, GENERAL, GREY, CHARACTER SEGMENTATION

- [18] C. Oliver, H. Miled, K. Romeo, and Y. Lecourtier. Segmentation and coding of Arabic handwritten words. In *Proceedings of the International Conference on Pattern Recognition*, pages 264–268, 1996.

KEY: oliver96

CATEGORIES: PREPROCESSING, WORD SEGMENTATION, TEXT PROCESSING, OCR, FOREIGN LANGUAGE, ARABIC

5.4 Feature Extraction

- [19] R. R. Bailey and M. Srinath. Orthogonal moment features for use with parametric and non-parametric classifiers. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 18(4):389–499, 1996.

KEY: bailey96

CATEGORIES: PREPROCESSING, FEATURE EXTRACTION, TEXT PROCESSING, OCR, GENERAL, CLASSIFIER

- [20] J.H. Chiang and P. Gader. A hybrid feature extraction framework for handwritten numeric fields recognition. In *Proceedings of the International Conference on Pattern Recognition*, pages 436–440,

1996.
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 CATEGORIES: PREPROCESSING, FEATURE EXTRACTION, TEXT PROCESSING, OCR, DIGIT, MACHINE PRINTED
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11.12 Digital Libraries

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12.11 Hardware

13 Miscellaneous