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Kajian teknik pengenalan kata tulisan-tangan menggunakan kombinasi jaringan syaraf tiruan perambatan-balik

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DAFTAR PUSTAKA

- Abuhaiba S. I., dan P. Ahmed. 1993. *A Fuzzy Graph Theoretic Approach to Recognize the Totally Unconstrained Handwritten Numerals*. Pattern Recognition, 26(9): 1335-1350.
- Alwi, H., S. Dardjowidjojo, H. Lapolika, dan A. M. Moeliono. 1998. *Tata Bahasa Baku Bahasa Indonesia*. Edisi Ketiga, Penerbit Balai Pustaka, Jakarta.
- Arica, N. dan F.T. Yarman-Vural. 2001. *An Overview of Character Recognition Focused On Off-line Handwriting*. IEEE Trans. Systems, Man, and Cybernetics – Part C: Application and Rev., 31(2): 216-233.
- Arica, N. dan F. T. Yarman-Vural. 2002. *Optical Character Recognition for Cursive Handwriting*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 24(6): 801-813.
- Augustin, E., O. Baret, D. Price, dan S. Knerr. 1998. *Legal Amount Recognition of French Bank Checks Using a Neural Network – Hidden Markov Model Hybrid*. Proceedings of 6th International Workshop Frontiers in Handwriting Recognition, Korea: 99-111.
- Ayat, N. E., M. Cheriet, dan C. Y. Suen. 2002. *Optimization of the SVM Kernels using an Empirical Error Minimization Scheme*. Proceeding of the International Workshop on Pattern Recognition with Support Vector Machine, Niagara Falls, Canada: 354-369.
- Bishop, C. M. 1995. *Neural Networks for Pattern Recognition*. Oxford University Press. Inggris.
- Bortolozzi, F., A. Britto Jr., L.S. Oliveira, dan M. Morita. 2005. *Recent Advances in Handwriting Recognition*. Document Analysis, Umapada Pal, Swapan K. Parusi, Bidyut B. Chauduri (editor): 1-31.
- Bozinovic, R.M. dan S.N. Srihari. 1989. *Off-Line Cursive Word Recognition*, IEEE Transactions on Pattern Analysis and Machine Intelligence, 11: 68 – 83.
- Brakensiek, A., D. Willett dan G. Rigoll. 2000. *Unlimited Vocabulary Script Recognition Using Character N-Grams*. Proceedings of 22 DAGM – Symposium, Tagungsband Springer-Verlag, Kiel, Jerman: 436-443.



- Breiman, L. 1996. *Bagging Predictors*. Machine Learning, 24(2): 123 – 140.
- Bunke, H. 2003. *Recognition of Cursive Roman Handwriting – Past, Present and Future*. Proceeding of 7th International Conference on Document Analysis and Recognition: 448-459.
- Burgess, C., J. Ben, J. Denker, Y. LeCun, dan C. Nohl. 1993. *Offline Recognition of Handwritten Postal Words Using Neural Network*. International Journal Pattern Recognition and Artificial Intelligence, 7(4): 689-704.
- Byun, H., dan S. W. Lee . 2002. *Applications of Support Vector Machines for Pattern Recognition*. Proceeding of The International Workshop on Pattern Recognition with Support Vector Machine, Niagara Falls-Canada: 213-236.
- Cano, J., J. Perez-Cortes, J. Arlandis, dan R. Llobet. 2002. *Training Set Expansion in Handwritten Character Recognition*. Proceedings of 9th SSPR/4th SPR, Windsor, Ontario, Canada: 548-556.
- Chen, M., A. Kundu dan J. Zhou. 1992. *Off-line Handwritten Word Recognition Using a Single Contextual Hidden Markov Model*. Proceeding of IEEE Computer Vision and Pattern Recognition (CVPR) Conference Champaign, Illinois, Amerika Serikat: 669-672.
- Chen, W. T., P. Gader, dan H. Shi. 1999. *Lexicon-Driven Handwritten Word Recognition Using Optimal Linear Combination of Order Statistics*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 21(1): 77-82.
- Clayton, A. 2006. *The Relative Importance Of Input Encoding And Learning Methodology On Protein Secondary Structure Prediction*. Tesis MSc, College of Arts and Sciences Georgia State University.
- Dimauro, G., S. Impedovo, G. Pirlo, dan A. Salzo. 1997. *Automatic Bankcheck Processing: A New Engineered System*. International Journal of Pattern Recognition and Artificial Intelligence, World Scientific: 467-503.
- Duda, R. O., P.E. Hart, dan D. G. Stork. 2001. *Pattern Classification*. Edisi Kedua. John Wiley and Sons, New York.
- Eastwood, B., A. Jennings, dan A. Harvey. 1997. *A Low Level Feature Based Neural Network Segmenter for Fully Cursive Handwritten Words*. Proceedings of International Conference on Document Analysis and Recognition: 523-527.
- Ethem, A. 1998. *Techniques for Combining Multiple Learners*. Proceedings of Engineering of Intelligent Systems '98 Conference, 2: 6-12.



Fausett, L. 1994. *Fundamentals of Neural Networks*. Prentice Hall International, Inc, New Jersey.

Freitas, F. Bortolozzi dan R. Sabourin. 2001. *Handwritten Isolated Word Recognition: An Approach based on Mutual Information for Feature Set Validation*. Proceedings of 6th International Conference on Document Analysis and Recognition, Seattle, Amerika Serikat: 665-669.

Gader P. D., B. Forester, M. Ganzberger, A. Billies, B. Mitchell, M. Whalen, dan T. Youcum. 1991. *Recognition of Handwritten Digits using Template and Model Matching*. Pattern Recognition, 5(24): 421-431.

Gader P. D., J. M. Keller, dan J. Cai. 1995. *A Fuzzy Logic System for Detection and Recognition of Street Number Fields on Handwritten Postal Addresses*. IEEE Transactions on Fuzzy Systems, 3(1): 83-95.

Gorski, N., V. Anisimov, E. Augustin, O Baret, dan S. Maximor. 2001. *Industrial Bank Check Processing: The A2iA Check Reader*. International Journal on Document Analysis and Recognition, 3: 196-206.

Guillevic dan C. Y. Suen. 1998. *HMM-kNN Word Recognition Engine for Bank Cheque Processing*. Proceeding of 14th International Conference on Pattern Recognition, Volume 2, Brisbane , Australia: 1526-1529.

Gunter, S. 2004 *Multiple Classifier Systems in Offline Cursive Handwriting Recognition*. Tesis PhD, Institute for Computer Science and Applied Mathematics, University of Bern, Jerman.

Haji, M. M. 2005. *Farsi Handwritten Word Recognition Using Continuous Hidden Markov Models and Structural Features*. Tesis MSc., Computer Engineering, Shiraz University, Iran.

Halmos, Paul R. 1993. *Finite-Dimensional Vector Spaces*, Springer-Verlag.

Hansen, L. dan O. Salomon. 1990. *Neural Network Ensembles*. IEEE Transactions on Pattern Recognition and Machine Analysis, 12(10): 993-1001.

Harris, F.J. 1978. *On the Use of Windows for Harmonic Analysis with the Discrete Fourier Transform*, Proceedings of the IEEE, 66(1): 51-83.

Hashem, S. 1997. *Optimal Linear Combinations of Neural Networks*. Neural Networks, 10(4): 599-614.

Haykin, S. 1994. *Neural Networks : A Comprehensive Foundation*. Prentice-Hall International Inc., New Jersey.



Ho, T.K. 1998. *The Random Supspace Method for Constructing Decision Forests*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 20(8):832 – 844.

Impedovo, S., P. Wang, dan H. Bunke (editor). 1997. *Automatic Bank Check Processing*. World Scientific.

Jacobs, R. A., M. I. Jordan, S. J. Nowlan, dan G. E. Hinton. 1991. *Adaptive Mixtures of Local Experts*. Neural Computation, 3: 79-87.

Jain, A. K. 1989. *Fundamentals of Digital Image Processing*. Prentice-Hall International Inc., New Jersey.

Jain, A. K., R. P. W. Duin, dan J. Mao. 2000. *Statistical Pattern Recognition: A Review*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 22(1): 4-37.

Jang, H. H , A. J. Park, dan K. C. Jung. 2008. *Neural Network Implementation Using CUDA and OpenMP*. Computing: Techniques and Applications: 155–161.

Kalenderli, Ö., S. Bolat, dan H. Ismailoglu. 2003. *Determination of Critical Impulse Breakdown Voltage by Artificial Neural Network*. Eleco 2003 International Conference on Electrical and Electronics Engineering, Bursa, Turkey: 235-239.

Kaltenmeier, A., T. Caesar, J. Gloer dan E. Mandler. 1993. *Sophisticated Topology of Hidden Markov Models for Cursive Script Recognition*. Proceedings of 2nd International Conference on Document Analysis and Recognition: 139-142.

Kang, H. J. dan S. W. Lee. 1999. *Combining Classifiers based on Minimization of Bayes Error Rates*. Proceedings of 5th International Conference Document Analysis and Recognition, Bangalore, India: 398-401.

Kapp, M. N., C. Freitas, dan R Sabourin. 2004. *Handwritten Brazilian Month Recognition: An Analysis of Two NN Architectures and A Rejection Mechanism*. Proceedings of 9th International Workshop on Frontiers in Handwriting Recognition, Kokubunji, Tokyo, Jepang: 209-214.

Kesavan, A. 2006. *Embedded Intelligence In Structural Health Monitoring Using Artificial Neural Networks*. Tesis PhD, School of Aerospace, Mechanical & Manufacturing Engineering, Melbourne, Victoria, Australia.



Kim, G. dan V. Govindaraju. 1997. *A Lexicon Driven Approach to Handwritten Word Recognition for Real-Time Applications*. IEEE Transactions on Pattern Analysis and Machine Intelligence 19(4): 366-379.

Kim, H. Y., dan J. H. Kim. 1998. *Handwritten Korean Character Recognition based on Hierarchical Random Graph Modeling*. Proceeding of 6th International Workshop on Frontiers of Handwriting Recognition, Taejon, Korea: 557-586.

Kim, H. Y., Kim K. K., dan C. Y. Suen. 2000. *An HMM-MLP Hybrid Model for Cursive Script Recognition*, Pattern Analysis and Applications, 3: 314-324.

Kimura, F., S. Tsuruoka, Y. Miyake, dan M. Shridhar. 1994. *A Lexicon Directed Algorithm for Recognition of Unconstrained Handwritten Words*. IEICE Transaction Information and Systems (Special Issue on Document Analysis and Recognition) E77-D(7): 785 – 793.

Kisacanin, B., S. S. Bhattacharyya, dan Sek Chai (editor). 2009. *Embedded Computer Vision*. Springer-Verlag Ltd. London.

Koch, T. Paquet, dan L. Heutte. 2004. *Combination of Contextual Information for Handwritten Word Recognition*. Proceedings of 9th International Workshop on Frontiers in Handwriting Recognition. October 26-29, Kokubunji, Tokyo, Jepang: 468-473.

Koerich, A. L. 2002. *Large Vocabulary Off-Line Handwritten Word Recognition*. PhD Thesis, Ecole de Technologie Supérieure, Montreal, Kanada.

Koerich, A. L., R. Sabourin, dan C. Y. Suen. 2004. *Fast Two-Level HMM Decoding Algorithm for Large Vocabulary Handwriting Recognition*. Proceeding of 9th International Workshop on Frontiers in Handwriting Recognition. October 26-29, Kokubunji, Tokyo, Jepang: 232-238.

Koerich, A. L., R. Sabourin, dan C. Y. Suen. 2005. *Recognition and Verification of Unconstrained Handwritten Words*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 27(10): 1509-1522.

Krogh, A. dan J. Vedelsby. 1995. *Neural Networks Ensembles, Cross Validations, and Active Learning*. Advances in Neural Information Processing Systems, G. Tesauro dkk (editor), MIT Press, 7: 231-238.

Lam, L. dan C. Y. Suen. 1994. *Increasing Experts for Majority Vote in OCR: Theoretical Considerations and Strategies*. Proceedings on International Workshop Frontiers in Handwriting Recognition, Taiwan: 245-254.



- Lazzerini, dan F. Marcelloni. 2000. *A Linguistic Fuzzy Recognizer of Off-Line Handwritten Characters*. Pattern Recognition Letters, 21(4): 319-327.
- LeCun, Y., L. Bottou, Y. Bengio, dan P. Haffner. 1998. *Gradient Based Learning Applied to Document Recognition*. Proceeding of IEEE, 86(11): 2278-2324.
- Lee, Y., S. Oh, dan M.Kim. 1991. *The Effect of Initial Weights on Premature Saturation in Backpropagation Learning*. International Joint Conference on Neural Networks, Seattle, Washington, Amerika Serikat, 1:765-770.
- Lee, S. W. dan Y. J. Kim. 1995. *Multiresolutional Recognition of Handwritten Numerals with Wavelet Transform and Multilayer Cluster Neural Network*. Proceedings of 3rd International Conference Document Analysis and Recognition, Montreal, Canada: 1010-1014.
- Ling, M. Lizaraga, N. Gomes, dan A. Koerich. 1997. *A Prototype for Brazilian Bankcheck Recognition*. International Journal of Pattern Recognition and Artificial Intelligence, World Scientific: 549-569.
- Lorette, G. 1999. *Handwriting Recognition or Reading? Situation at the Dawn of the 3rd Millennium*. Advances in Handwriting Recognition, Seong-Whan Lee (editor), World Scientific, Singapura: 3-15.
- Lu, W. 2000. *Neural Network Model For Distortional Buckling Behaviour Of Cold-Formed Steel Compression Members*. Tesis LSc, Department of Civil and Environmental Engineering, Helsinki University of Technology.
- Marti, U., dan H. Bunke. 2000. *Handwritten Sentence Recognition*. Proceeding 15th International Conference on Pattern Recognition, Barcelona, Spanyol: 467-470.
- Micusik, D., dan V. Stopjakova. 2002. *Application of Feed Forward Artificial Neural Network to the Identification of Defective Analog Integrated Circuits*. Neural Computing & Applications Journal, Springer-Verlag, 11: 71-79.
- Milewski, R.J. 2006. *Automatic Recognition of Handwritten Medical Forms for Search Engines*. Tesis PhD, University of New York at Buffalo, Amerika Serikat.
- Minsky, M. L. dan A. S. Papert. 1969. *Perceptrons: An Introduction to Computational Geometry*. MIT Press.
- Minsky, M. L. dan A. S. Papert. 1988. *Perceptrons, Expanded Edition*. MIT Press.

Misiti, M., Y. Misiti, G. Oppenheim, dan J.-M. Poggi. 2005. *Wavelet Toolbox: For Use with MATLAB, Version 3*, The Mathworks Inc., Massachusetts.

Mohamed, A. dan P. Gader. 1996. *Handwritten Word Recognition using Segmentation-Free Hidden Markov Modeling and Segmentation-Based Dynamic Programming Techniques*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 18(5): 548-554.

Mori, M., A. Suzuki, A. Saho dan S. Ohtsuka. 2000. *Generating New Samples from Handwritten Numerals based on Point Correspondence*. Proceedings of 7th International Workshop on Frontiers in Handwriting Recognition: 309-312.

Mozzafari, S., K. Faez, dan H. R. Kanan, 2004, *Feature Comparison between Fractal Codes and Wavelet Transform in Handwritten Alphanumeric Recognition Using SVM Classifier*. Proceedings of 17th International Conference on Pattern Recognition, Cambridge, Inggris, 2: 331-334.

Mozaffari, S., K. Faez, H. R. Kanan, dan M. Ziyaratban. 2005. *Farsi/Arabic Handwritten Digit Recognition Using Fractal, Wavelet Nearest Neighbor Classifiers and Eigenimage Method*. Proceedings of the First International Conference on Modeling, Simulation and Applied Optimnization, Sharjah, Uni Emirat Arab.

Mudjihardjo, P. 2001. *Penerapan Jaringan Perambatan Balik untuk Pengenalan Kode Pos Tulisan Tangan*. Tesis S-2, Teknik Elektro, Universitas Gadjah Mada, Yogyakarta, Indonesia.

Oh, S. dan C. Y. Suen. 1998. *Distance Features for Neural Network based Recognition of Handwritten Characters*. International Journal on Document Analysis and Recognition, 1(2): 73-88.

Oliveira, S., dan R. Sabourin. 2004. *Support Vector Machines for Handwriting Numerical String Recognition*. Proceeding of 9th International Workshop on Frontiers in Handwriting Recognition, Kokubunji, Tokyo, Jepang: 39-44.

Omondi, A.R., dan J. C. Rajapakse. 2006. *FPGA Implementations of Neural Networks*. Springer. Dordrecht.

Optiz, D. W. 1999. *Feature Selection for Ensembles*. Proceeding of 16th International Conference on Artificial Intelligence: 379-384.

Otsu, N. 1979. *A Threshold Selection Method from Gray-Level Histograms*. IEEE Transactions on Systems, Man, and Cybernetics, 9(1): 62-66.



- Partridge, D. dan Y. B. Yates. 1996. *Engineering Multiversion Neural-Net Systems*. Neural Computation, 8(4): 869-893.
- Paterson, D. W. 1996. *Artificial Neural Networks*. Prentice Hall International, Inc, New Jersey.
- Plotz, T., C. Thurau, dan G.A. Fink. 2008. *Camera-Based Whiteboard Reading: New Approaches to a Challenging Task*. Proceeding of International Conference and Frontiers of Hanwriting Recognition: 385-390.
- Rabiner, L. R. 1989. *A Tutorial on Hidden Markov Models and Selected Applications in Speech Recognition*. Proceedings of the IEEE, 77(2): 257-286.
- Riedmiller, M. dan H. Braun. 1993. *A Direct Adaptive Method for Faster Backpropagation Learning: The RPROP Algorithm*. Proceedings of the IEEE International Conference on Neural Networks: 586-591.
- Rosenblatt, F. 1962. *Principles of Neurodynamics*. Spartan, New York.
- Russel, N. dan P. Norvig. 2003. *Artificial Intelligence: A Modern Approach*. Edisi kedua. Prentice Hall International, Inc., New Jersey.
- Säckinger, E., B.E. Boser, J. Bromley, Y.L. Cun, dan L.D. Jackel. 1992. *Application of the ANNA neural network chip to high-speed character recognition*, IEEE Transactions On Neural Networks 3: 489-505.
- Sayre, K. 1973. *Machine Recognition of Handwritten Words: A Project Report*. Pattern Recognition, 5 (3): 213-228.
- Schalkoff, R. J. 1989. *Digital Image Processing and Computer Vision*. John Wiley & Sons, Inc., New York.
- Schurmann, J. 1996. *Pattern Classification – A Unified View of Statistical and Neural Approaches*. Wiley Interscience.
- Senior, A. W. 1994. *Off-line Cursive Handwriting Recognition using Recurrent Neural Networks*. Tesis PhD, Cambridge: Cambridge University Engineering Department.
- Setiawan, W. 2000. *Pengenalan Kata Tulisan Tangan pada Aplikasi Pembacaan Nilai Terbilang Check dengan Jaringan Neural*. Tesis S-2, Teknik Elektro, Universitas Gadjah Mada, Yogyakarta, Indonesia.

Shioyama, T., H. Y. Wu, dan T. Nojima. 1998. *Recognition Algorithm Based On Wavelet Transform for Handprinted Chinese Characters*. Proceedings of 14th International Conference on Pattern Recognition, 1: 339-232.

Simon, J. -C. 1992. *Off-line Cursive Word Recognition*. Proceeding of the IEEE, 80(7): 1150-1161.

Slavik, V., dan V. Govindaraju. 2001. *Equivalence of Different Methods for Slant and Skew Corrections in Word Recognition Applications*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 3(3): 323-326.

Srihari, S. 2000. *Handwritten Address Interpretation: A Task of Many Pattern Recognition Problems*. International Journal of Pattern Recognition and Artificial Intelligence, 14: 663-674.

Shridhar M., dan A. Badreldin. 1986. *Recognition of Isolated and Simply Connected Handwritten Numerals*. Pattern recognition, 19(1), hal. 1-12.

Suhardi, I. 2003. *Evaluasi Jaringan Saraf Tiruan untuk Pengenalan Karakter Tulisan Tangan Jenis Cetak*. Tesis S-2, Teknik Elektro, Universitas Gadjah Mada, Yogyakarta.

Sumarno, L. 2006. *Pengenalan Huruf Tulisan Tangan Berderau dan Terskala Berbasiskan Ekstraksi Ciri Penyelekaan dengan Menggunakan Jaringan Syaraf Tiruan Probabilistik*. Proceeding Seminar Nasional Teknologi, Fakultas Teknik, Universitas Sanata Dharma, Yogyakarta: 268-276.

Sumarno, L. 2007a. *Evaluasi Unjukkerja Ekstraksi Ciri Wavelet dalam Pengenalan Huruf Tulisan Tangan Berderau dan Terskala menggunakan Jaringan Syaraf Probabilistik*. Jurnal Teknologi Media Teknika, 7(1) 1-15.

Sumarno, L. 2007b. *Pengenalan Huruf Tulisan Tangan Berderau dan Terskala Berbasis Ekstraksi Ciri DCT dengan Menggunakan Jaringan Syaraf Probabilistik*. Jurnal Sains dan Teknologi Sigma, 10(2): 185-197.

Sumarno, L. 2008. *Segmentasi Kata Tulisan Tangan Menggunakan Wavelet*. Jurnal Teknologi Komputer Compile, 1(1): 80-87.

Sumarno, L., A. Susanto, T.S. Widodo, dan J. E. Istiyanto. 2009a. *Segmentasi Kata Tulisan Tangan Menggunakan Tapis Gaussian 1D*. Jurnal Sains dan Teknologi Sigma, 12(2): 179-189.

Sumarno, L. 2009b. *On The Performance of Blurring and Block Averaging Feature Extraction Based On 2D Gaussian Filter*. Proceeding of 5th International Conference on Information and Communication Technology and Systems (ICTS): 261-266.



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The Mathworks Inc. 2005a. *Image Processing Toolbox: For Use with MATLAB, Version 5.0.2.* The Mathworks Inc., Massachusetts.

The Mathworks Inc. 2005b. *Neural Network Toolbox: For Use with MATLAB, Version 4.0.5.* The Mathworks Inc., Massachusetts.

Trier, O. D., A. K. Jain, dan T. Taxt. 1996. *Feature Extraction Methods for Character Recognition – A Survey*, Pattern Recognition, 29: 641 – 662.

Vapnik, V. 1995. *The Nature of Statistical Learning Theory*. Springer-Verlag. New York.

Woods, R., J. McAllister, G. Lightbody, dan Y. Yi. (editor). 2008. *FPGA-based Implementation of Signal Processing Systems*. John Wiley & Sons Ltd., Sussex.

Wolperk, D. H. 1992. *Stacked Generalization*. Neural Networks, 5: 241-259.

Xie, S. L., dan M. Suk. 1988. *On Machine Recognition of Hand-printed Chinese Character by Feature Realxation*. Pattern Recognition, 21(1): 1-7.

Xu, Q. 2002. *Automatic Segmentation and Recognition System for Handwritten Dates on Cheques*. Tesis PhD, Concordia University, Montreal, Kanada.

Yacoubi, El, M. Gilloux, R. Sobourin, dan C.Y. Suen. 1999. *An HMM-Based Approach for Off-Line Unconstrained Handwritten Word Modeling and Recognition*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 21(8): 752-760.

Zhang, T.Y. dan C. Y. Suen. 1984. *A Fast Parallel Algorithm for Thinning Digital Patterns*. Comm. ACM, 27(3): 236-239.

Zhang, M. Fu, H. Yan, dan M. A. Fabri. 1999. *Handwritten Digit Recognition by Adaptive Subspace Self Organizing Map*. IEEE Transactions on Neural Networks, 10: 939-945.

Zhou, J. 1999. *Recognition and Verification of Unconstrained Handwritten Numeral*. Tesis PhD , Concordia University, Montreal, Kanada.

Zimmermann, M. 2003. *Offline Hadwriting Recognition and Grammar based Syntax Analysis*. Tesis PhD, Bern University, Jerman.