

**Prof. BURCU
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Personal Information

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International Researcher IDs

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Education Information

2002 - 2007	Doctorate, Yıldız Technical University, Elektrik Elektronik Fakültesi, Turkey
1999 - 2001	Postgraduate, Yıldız Technical University, Elektrik Elektronik Fakültesi, Turkey
1995 - 1999	Undergraduate, Yıldız Technical University, Elektrik Elektronik Fakültesi, Turkey

Dissertations

2007	Genel Amaçlı Bir Yapay Sinir Ağı'nın Karma Bir Donanımla Gerçeklenmesi, Yıldız Teknik Üniversitesi, Elektrik Elektronik Fakültesi, Elektronik Ve Haberleşme Müh. Bölümü, Doctorate
2001	USB Cihaz Arayüzüne Ait Protokol Katmanı Tasarımı, Yıldız Teknik Üniversitesi, Elektrik Elektronik Fakültesi, Elektronik Ve Haberleşme Müh. Bölümü, Postgraduate

Academic Titles / Tasks

2021 - Continues	Professor, Yıldız Technical University, Faculty Of Electrical & Electronics, Electronics And Communication Engineering
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Academic and Administrative Experience

2021 - 2023	BAP Coordinator, Yıldız Technical University, Faculty Of Electrical & Electronics, Electronics And Communication Engineering
2019 - 2020	Vice Dean, Yıldız Technical University, Faculty Of Electrical & Electronics, Electronics And Communication Engineering

Supervised Theses

2022	Erkmek B., Postgraduate, O.YILDIRIM(Student), Field programmable gate array implementation of spiking neural networks
2022	Erkmek B., Postgraduate, S.ATAY(Student), Yapay zeka algoritmaları kullanarak kompanzasyon kapasitörleri için kalan faydalı ömür kestirimi

2022	Erkmen B., Postgraduate, M.EMRE(Student), Heterojen gömülü hesaplama kullanılarak ileri yol şerit tespiti
2022	Erkmen B., Postgraduate, M.EFDAL(Student), Nöromorfik hesaplama sistemine yönelik devre tasarımı
2022	Erkmen B., Postgraduate, O.YALÇIN(Student), Gerçek zamanlı değişken yük üzerinde optimizasyon
2020	Erkmen B., Postgraduate, D.ERSOY(Student), 2 boyutlu stokastik hesaplama yöntemiyle fonksiyon gerçekleştirme
2020	Erkmen B., Doctorate, K.KERİM(Student), Doğrusal frekans modülasyonlu sürekli dalgaformu sinyallerinin tespiti ve parametrelerinin çıkarımı için bir gömülü sistem tasarımı
2019	Erkmen B., Doctorate, A.Rıza(Student), Computational Intelligence Based Power Electronics Circuit Design
2019	Erkmen B., Doğan H., Postgraduate, C.AYAN(Student), Logaritmik Güç Detektörü Tasarımı
2019	Erkmen B., Postgraduate, M.GÜNER(Student), Biomedical signal-based control system design
2019	Erkmen B., Doctorate, A.RIZA(Student), Empedans kaynaklı inverterin işlemsel zekâ tabanlı kontrolü
2017	Erkmen B., Postgraduate, B.GUKSA(Student), The detection of sleeping condition in different place conditions using smart phone
2017	Erkmen B., Postgraduate, F.SEREZ(Student), Determination and realization of sensorless position detection method for a brushless DC motor
2017	Erkmen B., Postgraduate, F.ÜCRACK(Student), Evaluation of learning levels of laparoscopic surgical simulations by electroencephalographic signal analysis
2015	Erkmen B., Postgraduate, N.AKKAN(Student), Graphene based analog circuit design
2015	Erkmen B., Postgraduate, H.GÜNEREN(Student), Face recognition application on embedded system using support vector machines
2014	Erkmen B., Postgraduate, İ.DEMİREL(Student), Power supply optimization for new technology adaptable televisions
2014	Erkmen B., Postgraduate, A.RIZA(Student), Training of artificial neural network with differential evolution algorithm on FPGA
2012	Erkmen B., Postgraduate, C.ÖZÇİFTÇİ(Student), Design and implementation of flyback inverter transferring energy to the grid

Jury Memberships

May 2020	Competition, TEKNOFEST / Environmental and Energy Technologies Competition, TEKNOFEST / Environment and Energy Technologies Competition
May 2019	Competition, TEKNOFEST / Artificial Intelligence Competition, TEKNOFEST / Artificial Intelligence Competition
September 2018	Competition, Teknofest/ Artificial Intelligence Competition, TEKNOFEST / Artificial Intelligence Competition

Research Infrastructure Information

January 2021	Erkmen B., Reconfigurable Computing and Integrated Design Laboratory
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Published journal articles indexed by SCI, SSCI, and AHCI

- I. Detection and classification of human respiration under building debris model using VHF/UHF waves
Niyaz Ö., Tüylü T., Mahouti P., Erkmen B., Tokan N. T.

NEURAL COMPUTING AND APPLICATIONS, vol.36, pp.1-17, 2024 (SCI-Expanded)

- II. **Integrated Approaches in Resilient Hierarchical Load Forecasting via TCN and Optimal Valley Filling Based Demand Response Application**
Türkoğlu A. S., Erkmen B., Eren Y., Erdiñç O., Küçükdemiral I. B.
Applied Energy, vol.360, pp.1-11, 2024 (SCI-Expanded)
- III. **BASISMAP: sequence-based similarity search for geomagnetic positioning**
Kadiođlu T., Erkmen B.
TURKISH JOURNAL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCES, vol.31, no.1, pp.146-162, 2023 (SCI-Expanded)
- IV. **A Low-Cost Real-Time BCI Integration for Automated Door Opening System**
Guner M., ERKMEN B.
JOURNAL OF CIRCUITS SYSTEMS AND COMPUTERS, vol.30, no.2, 2021 (SCI-Expanded)
- V. **FPGA-Based Wigner-Hough Transform System for Detection and Parameter Extraction of LPI Radar LFM CW Signals**
Guner K. K., Gulum T. O., ERKMEN B.
IEEE TRANSACTIONS ON INSTRUMENTATION AND MEASUREMENT, vol.70, 2021 (SCI-Expanded)
- VI. **Design of gain-scheduling PID controllers for Z-source inverter using iterative reduction-based heuristic algorithms**
YILMAZ A. R., EROL B., DELİBAŞI A., ERKMEN B.
SIMULATION MODELLING PRACTICE AND THEORY, vol.94, pp.162-176, 2019 (SCI-Expanded)
- VII. **FPGA-Based Space Vector PWM and Closed Loop Controllers Design for the Z Source Inverter**
Yilmaz A. R., Erkmen B.
IEEE ACCESS, vol.7, pp.130865-130873, 2019 (SCI-Expanded)
- VIII. **Process independent automated sizing methodology for current steering DAC**
Vural R., Kahraman N., Erkmen B., Yıldırım T.
INTERNATIONAL JOURNAL OF ELECTRONICS, vol.102, no.10, pp.1713-1734, 2015 (SCI-Expanded)
- IX. **A Very Low-Profile Dual Output LLC Resonant Converter for LCD/LED TV Applications**
Demirel I., Erkmen B.
IEEE TRANSACTIONS ON POWER ELECTRONICS, vol.29, pp.3514-3524, 2014 (SCI-Expanded)
- X. **A Mixed Mode Neural Network Circuitry for Object Recognition Application**
Erkmen B., Vural R., Kahraman N., Yıldırım T.
CIRCUITS SYSTEMS AND SIGNAL PROCESSING, vol.32, no.1, pp.29-46, 2013 (SCI-Expanded)
- XI. **Conic Section Function Neural Network Circuitry for Offline Signature Recognition**
Erkmen B., Kahraman N., Vural R., Yıldırım T.
IEEE TRANSACTIONS ON NEURAL NETWORKS, vol.21, no.4, pp.667-672, 2010 (SCI-Expanded)
- XII. **THRESHOLD VOLTAGE MODELING USING NEURAL NETWORKS**
Kahraman N., Erkmen B., Yıldırım T.
NEURAL NETWORK WORLD, vol.19, no.3, pp.255-262, 2009 (SCI-Expanded)
- XIII. **Improving classification performance of sonar targets by applying general regression neural network with PCA**
Erkmen B., Yıldırım T.
EXPERT SYSTEMS WITH APPLICATIONS, vol.35, pp.472-475, 2008 (SCI-Expanded)
- XIV. **Statistical neural network based classifiers for letter recognition**
Erkmen B., Yıldırım T.
Lecture Notes in Control and Information Sciences, vol.345, pp.1081-1086, 2006 (SCI-Expanded)
- XV. **Conic section function neural networks for sonar target classification and performance evaluation using ROC analysis**
Erkmen B., Yıldırım T.
Lecture Notes in Control and Information Sciences, vol.345, pp.779-784, 2006 (SCI-Expanded)

Articles Published in Other Journals

- I. **IoT-based fire detection: A comparative study of machine learning techniques**
Ayrancı A. A., Erkmén B.
Niğde Ömer Halisdemir Üniversitesi Mühendislik Bilimleri Dergisi, vol.13, no.4, pp.1298-1307, 2024 (Peer-Reviewed Journal)
- II. **FPGA BASED RECONFIGURABLE IMPLEMENTATIONS OF SPIKING NEURAL NETWORKS: A MINI REVIEW**
Yıldırım O., Niyaz Ö., Erkmén B.
Tasarım, Mimarlık ve Mühendislik Dergisi, vol.2, no.2, pp.152-161, 2022 (Peer-Reviewed Journal)
- III. **A Stochastic Computing Method For Generating Activation Functions in Multilayer Feedforward Neural Networks**
Ersoy D., ERKMEN B.
ELECTRICA, vol.21, no.3, pp.376-388, 2021 (ESCI)
- IV. **IMPLEMENTATION OF SENSORLESS POSITION DETECTION CIRCUIT WITH FOUR-SWITCH INVERTER TOPOLOGY FOR A PERMANENT MAGNET SYNCHRONOUS MOTOR**
Serez F., Erkmén B.
SIGMA JOURNAL OF ENGINEERING AND NATURAL SCIENCES-SIGMA MUHENDISLIK VE FEN BILIMLERI DERGISI, vol.38, no.1, pp.311-327, 2020 (ESCI)
- V. **Intelligent Wireless Sensor Networks for Early Fire Warning System**
Önal A. F., Ülver B., Durusoy A., Erkmén B.
Electrica, vol.20, no.1, pp.1-9, 2020 (ESCI)
- VI. **KAPALI ALAN YAYA KONUMLANDIRMA SİSTEMİ**
Aydın H., Erkmén B.
Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü Dergisi, vol.7, no.2, pp.337-344, 2019 (Peer-Reviewed Journal)
- VII. **Design and optimization of a power supply unit for low profile LCD/LED TVs**
Acar Vural R., Demirel İ., Erkmén B.
An International Journal of Optimization and Control: Theories and Applications, vol.7, pp.158-166, 2017 (Peer-Reviewed Journal)
- VIII. **ACCELERATING HANDWRITTEN SIGNATURE RECOGNITION USING INTELLIGENT ALGORITHM BASED EMBEDDED SYSTEM**
Yılmaz A. R., Erkmén B., Yavuz O.
SIGMA JOURNAL OF ENGINEERING AND NATURAL SCIENCES-SIGMA MUHENDISLIK VE FEN BILIMLERI DERGISI, vol.34, no.3, pp.393-405, 2016 (ESCI)
- IX. **Determination of Approximate Main Engine Power for Chemical Cargo Ships Using Radial Basis Function Neural Network**
Erkmén B., Çelebi U. B., Ekinci S., Yıldırım T.
Journal of Naval Science and Engineering, no.2, pp.105-115, 2004 (Peer-Reviewed Journal)

Refereed Congress / Symposium Publications in Proceedings

- I. **Investigation of temperature, humidity and force-sensitive sensors for future smart bed pads**
Aydın Ş. Z., Beken G. N., Atas K., Akgöl V., Erkmén B., Acar Vural R.
Fifteenth International Conference on Signal Processing Systems (ICSPPS 2023), 17 - 19 November 2023, pp.715-724
- II. **Deep Long Short-Term Memory Networks for Asthma Disease Prediction from Respiratory Dataset Obtained from the PEEP Expiratory Occlusion**
Beken G. N., Aydın Ş. Z., Erkmén B.
47th International Conference on Telecommunications and Signal Processing, TSP 2024, Virtual, Online, Czech Republic, 10 - 12 July 2024, pp.239-242
- III. **Edge Computing and Robotic Applications in Modern Agriculture**
AYRANCI A. A., ERKMEN B.
6th International Congress on Human-Computer Interaction, Optimization and Robotic Applications, HORA 2024, İstanbul, Turkey, 23 - 25 May 2024

- IV. **Capacity Loss Analysis Using Machine Learning Regression Algorithms**
Atay S., Ayranci A. A., ERKMEN B.
9th International Conference on Electrical and Electronics Engineering (ICEEE), Alanya, Turkey, 29 - 31 March 2022, pp.10-13
- V. **Robust Tuning of PID Controller Using Differential Evolution Algorithm Based on FPGA**
Yalcin O., Canli A., Yilmaz A. R., ERKMEN B.
9th International Conference on Electrical and Electronics Engineering (ICEEE), Alanya, Turkey, 29 - 31 March 2022, pp.180-184
- VI. **V/UHF FREQUENCY BAND CMOS LOGARITHMIC RF POWER DETECTOR DESIGN**
Ayan C., Doğan H., Erkmen B.
4. International Congress on Engineering, Architecture and Design, İstanbul, Turkey, 23 - 24 April 2019, pp.459-465
- VII. **EMPEDANS KAYNAKLI İNVERTERLER İÇİN ÇOK SEVİYELİ PID KONTROLÖR TASARIMI**
Yılmaz A. R., Erkmen B.
4. Uluslararası Bilimsel Araştırmalar Kongresi, UBAK 2019, Yalova, Turkey, 14 - 17 February 2019, pp.75-80
- VIII. **Real-Time, Portable EEG Signal Acquisition System**
Guner M., Erkmen B.
2018 Medical Technologies National Congress (TIPTEKNO), Gazimagusa, Cyprus (Kktc), 8 - 10 November 2018, pp.1-4
- IX. **Smart phone application for drowsiness detection during driving**
GÜKSA B., ERKMEN B.
2017 2nd International Conference on Frontiers of Sensors Technologies (ICFST), 14 - 16 April 2017
- X. **Face recognition, NFC and voice controlled door lock system**
ADALAN K., ERKMEN B.
2016 National Conference on Electrical, Electronics and Biomedical Engineering (ELECO), Turkey, 1 - 03 December 2016
- XI. **Analysis of Graphene Field Effect Transistor Based Current Mirrors**
Akkan N., Erkmen B.
7th IEEE Latin American Symposium on Circuits and Systems (LASCAS), Florianopolis, Brazil, 28 February - 02 March 2016, pp.83-86
- XII. **Implementation Aspects of Wigner-Hough Transform Based Detectors for LFM CW Signals**
GUNER K. K., ERKMEN B., GULUM T. O., ERDOĞAN A., YILDIRIM T., Ata L. D.
39th International Conference on Telecommunications and Signal Processing (TSP), Vienna, Austria, 27 - 29 June 2016, pp.441-444
- XIII. **Improving Wigner Hough Transform for hardware implementation to intercept LFM CW signals**
GÜNER K. K., ERKMEN B., GULUM T., ERDOĞAN Y., YILDIRIM T., DURAK ATA L.
2015 23rd Signal Processing and Communications Applications Conference (SIU), Malatya, Turkey, Turkey, 16 - 19 May 2015
- XIV. **İşaretlerinin Kestirimi için Wigner Hough Dönüşümünün Donanım Uygulamasına Yönelik İyileştirilmesi**
güner k., ERKMEN B., gülüm t., Erdoğan A., YILDIRIM T., DURAK ATA L.
Sinyal İşleme ve Uygulamaları Kurultayı, Turkey, 16 - 19 May 2015
- XV. **FPGA Implementation of Differential Evaluation Algorithm for MLP Training**
Yilmaz A. R., ERKMEN B., Yavuz O.
IEEE International Symposium on Innovations in Intelligent Systems and Applications (INISTA), Alberobello, Italy, 23 - 25 June 2014, pp.425-430
- XVI. **CMOS Differential Amplifier Area Optimization with Evolutionary Algorithms**
ACAR VURAL R., ERKMEN B., BOZKURT U., YILDIRIM T.
The World Congress on Engineering and Computer Science (WCECS), San-Francisco, United States Of America, 23 - 25 October 2013, vol.2, pp.666-670
- XVII. **The performance of differential evolution algorithm for training CSFNN using a pattern recognition application**

Yilmaz A. R., ERKMEN B., Yavuz O.

2013 4th International Conference on Intelligent Control and Information Processing, ICICIP 2013, Beijing, China, 9 - 11 June 2013, pp.820-823

- XVIII. **Field programmable gate array implementation of conic section function neural network: An alternative to analog CSFNN circuitry**
Elitas M., Yavuz O., ERKMEN B.
IEEE 16th International Conference on Intelligent Engineering Systems, INES 2012, Lisbon, Portugal, 13 - 15 June 2012, pp.135-138
- XIX. **Genel Amaçlı Konik Kesit Fonksiyonlu Sinir Ağı Tümdevresi Üzerinde Obje Tanıma**
ACAR VURAL R., KAHRAMAN N., ERKMEN B., YILDIRIM T.
SIU 2008 IEEE 16th Signal Processing, Communication and Applications Conference, Turkey, 20 - 22 April 2008
- XX. **Genel Amaçlı Konik Kesit Fonksiyonlu Sinir Ağı Tümdevresi Üzerinde Obje Tanıma**
ACAR VURAL R., Kahraman N., Erkmen B., Yildirim T.
IEEE 16. Sinyal İşleme ve Uygulamaları Sempozyumu (SİU2008), Aydın, Turkey, 20 April 2008, pp.1-5
- XXI. **CSFNN optimization of signature recognition problem for a special VLSI NN chip**
Erkmen B., Kahraman N., Vural R., Yidirim T.
3rd IEEE International Symposium on Control, Communications and Signal Processing (ISCCSP 2008), St Julians, Malta, 12 - 14 March 2008, pp.1082-1085
- XXII. **VLSI Implementation of General Purposed Conic Section Function Neural Network**
Erkmen B., Yıldırım T.
5th International Conference on Electrical and Electronics Engineering (ELECO), Bursa, Turkey, 5 - 09 December 2007, vol.2, pp.80-84
- XXIII. **Obtaining decision boundaries of CSFNN neurons using current mode analog circuitry**
ERKMEN B., YILDIRIM T.
ECCTD 2007. 18th European Conference on Circuit Theory and Design, 2007., 27 - 30 August 2007
- XXIV. **CSFNN synapse and neuron design using current mode analog circuitry**
ERKMEN B., Yidirm T.
11th International Conference on Knowledge-Based and Intelligent Information and Engineering Systems, KES 2007, and 17th Italian Workshop on Neural Networks, WIRN 2007, Vietri sul Mare, Italy, 12 - 14 September 2007, pp.17-25
- XXV. **Efficient Training of Recurrent Neural Nets for Macromodeling p MOSFET at Microwave Frequencies Using Levenberg Marquardt Learning Algorithm**
ACAR VURAL R., ERKMEN B.
Proceedings of the Ninth International Conference on Engineering Applications of Neural Networks (EANN), Lille - Fransa, 1 August - 03 December 2005, vol.1, pp.171-178
- XXVI. **Macromodeling P MOSFET at Microwave Frequencies Using Elman Network**
ERKMEN B., ACAR VURAL R., ŞENGÖR N. S.
International Conference on Applied Electronics, Pilsen - Çek Cumhuriyeti, 1 - 03 September 2004, pp.105-108
- XXVII. **Yapay Sinir Ağları için Düşük Güçlü Dört Bölge CMOS Analog Çarpıcı**
ERKMEN B., YILDIRIM T.
SİU 2004, IEEE 12. Sinyal İşleme ve İletişim Uygulamaları Kurultayı, Turkey, 28 - 30 April 2004
- XXVIII. **Generalized Regression Neural Networks For Underwater Target Classification**
ERKMEN B., YILDIRIM T.
2nd International symposium on Electrical and Computer Engineering (NEU-CEE), Lefkoşa - Kuzey Kıbrıs Türk Cumhuriyeti, 11 - 13 March 2004, pp.223-225
- XXIX. **Standart Öklid mesafesi hesaplayan bir CMOS analog devrenin RBF ağlarına uyarlanması**
ÇOBAN Y., ERKMEN B., YILDIRIM T.
Elektrik-Elektronik-Bilgisayar Mühendisliği 10. Ulusal Kongresi, Turkey, 18 - 21 September 2003
- XXX. **A novel four quadrant CMOS analog multiplier for artificial neural networks**
ERKMEN B., YILDIRIM T.
XII. TAINN Symposium Proceedings, 2 - 04 July 2003

XXXI. Yapay sinir ağlarında kullanılan dört bölge CMOS analog çarpıcı

ERKMEN B., YILDIRIM T.

Elektrik-Elektronik-Bilgisayar Mühendisliği 8. Ulusal Kongresi, Turkey, 6 - 12 September 1999

Supported Projects

2024 - Continues	Okçuluk Sporunda Atletik Performansın Değerlendirilmesine Yönelik Yapay Zeka Destekli Sensörlü Biyomekanik Hareket Analizi, Project Supported by Higher Education Institutions
2023 - Continues	VR Tabanlı Solunum Rehabilitasyonuna Yönelik Yapay Zeka Temelli Karar Destek ve Takip Sistemi, Project Supported by Higher Education Institutions
2024 - 2027	Çoklu Parametrelili Sensörler İçin Düşük Güçlü Ve Gürbüz Nöromorfik Kablosuz Okuma Devresi, TUBITAK Project
2023 - 2026	Jet Physics Analyses and R&D Studies of HCAL-HGCAL Detectors in the CMS Experiment at CERN, Other International Funding Programs
2021 - 2025	Nöromorfik İşlemci Tabanlı Enerji Etkin Görüntü Sınıflandırma Sistemi, Project Supported by Higher Education Institutions
2023 - 2024	Yapay-Zeka Tabanlı Göçük Altı Arama-Kurtarma Danışmanlık Hizmeti, Project Supported by Other Official Institutions
2022 - 2024	Çoklu Sensör Veri Füzyonu ve Yapay Zeka Destekli Bası Yarısı İzleme ve Değerlendirme Sistemi, Research Project of the Presidency of Turkey Health Institutes (TÜSEB)
2022 - 2024	Deprem Sonrası Göçük Altı Canlı Tespiti İçin Yapay Zeka Tabanlı Frekans-Adımlı Multistatik Geniş Bantlı Radar Yaklaşımı, TUBITAK Project
2020 - 2022	Optik Girişli İçnecikli Yapay Sinir Ağları Tümüleşik Devre Tasarımı, Project Supported by Higher Education Institutions
2021 - 2021	Çerkezköy Organize Sanayi Bölgesi Dijital Dönüşüm Olgunluk Seviyesi Belirleme, Dijital Dönüşüm Yol Haritası Çıkartma, Development Agency
2021 - 2021	Sanayide Dijital Dönüşüm Eğitim ve Danışmanlık Merkezi Projesi, Technopark
2021 - 2021	Üniversite Kampüslerinin Dijitalleşme Sürecinin Analizi, Project Supported by Higher Education Institutions
2019 - 2020	Otonom Araçların Trafik İşaretlerini Tanımasına Yönelik Fpga Tabanlı Derin Öğrenme Sistemi, TUBITAK Project
2014 - 2016	Siber Güvenlik ve Biyometrik Araştırmalar Danışmanlık ve Test Merkezi Kurulumu, CB Strateji ve Bütçe Başkanlığı (Kalkınma Bakanlığı) Projesi
2013 - 2015	Detection of Low-probability-of-intercept Radar Signals by Time-Frequency Signal Processing and Extraction of their Parameters, TUBITAK Project
2012 - 2015	Genel Amaçlı Konik Kesit Fonksiyonlu Sinir Ağının ve Eğitim İşleminde Kullanılan Optimizasyon Algoritmalarının FPGA Üzerinde Gerçeklenmesi, Project Supported by Higher Education Institutions
2012 - 2013	Yeni Teknolojiye Uygun Televizyonlar İçin Güç Kaynağı Optimizasyonu, Company
2010 - 2012	Electronic Circuit Design Automation with Particle Swarm Optimization and Artificial Neural Networks, Project Supported by Higher Education Institutions
2005 - 2008	Implementation of a General Purpose Artificial Neural Network with Mixed Hardware, TUBITAK Project
2004 - 2006	Development and Testing of Artificial Neural Network Based Software for Selection of MOS Semiconductor Parameters in Analog Integrated Circuit Design, Project Supported by Higher Education Institutions