Bilkent University
Computer Engineering Department

MSc and PhD Programs

Prof. Dr. Ibrahim Korpeoglu
Research Areas

- Algorithms, artificial intelligence, big data, bioinformatics, cloud computing, computational biology, computational geometry, computer architecture, computer graphics, computer networks, computer vision, cryptography, data mining, data science, data security, database systems, graph visualization, high performance computing, image analysis, information retrieval, machine learning, mobile systems, parallel and distributed systems, pattern recognition, performance evaluation, scientific computing, virtual reality.
Applications

• Application Deadlines:
  Early: April 6, 2020; Regular: May 31, 2020

• Online Application:
  https://stars.bilkent.edu.tr/gradapp/

• Requirements for application:
  – CGPA ≥ 2.80 / 4.00
  – ALES (Turkish citizens) or GRE (Foreign applicants)
    • ALES: Quantitative ≥ 55 (for MS), 80 (for PhD w/o BS)
    • GRE: Quantitative ≥ 153 (MS), 157 (PhD)
  – English Proficiency: TOEFL (IBT) ≥ 87 or
    IELTS avg ≥ 6.5 (and min 5.5 in each section)
  – And YDS ≥ 55 (for Turkish citizen applying PhD).
Interview

• **Date:** April X, 2020; June X, 2020
  – We will inform applicants about interview dates

• If not uploaded during online application, hard copy documents to be submitted during interview:
  – Transcript
  – ALES or GRE score report
  – Proof of English Proficiency (TOFLE, IELTS or YDS report)
Acceptance requirements

• Grad committee approval
• At least one faculty member willing to work with the applicant towards thesis
• Passing the interview, and department approval
• Graduate School of Engineering and Science approval
Scholarship Options

• Department scholarship
  – Tuition waiver
  – Stipend
  – Accommodation support
  – Health Insurance
  – Additional Scholarship for Teaching Assistantship
  – Office (shared)

• TÜBİTAK Scholarship or TÜBİTAK projects
  – Tuition waiver
  – Accommodation
  – Health Insurance
  – Office (shared)
Scholarship Options

• Project grants (other than TÜBİTAK projects)
  – Tuition waiver
  – Stipend (paid from the project budget)
  – Accommodation
  – Health Insurance (paid from the project budget)
  – Additional Scholarship for Teaching Assistantship
  – Office (shared)

• Graduate School scholarship
  – Tuition waiver
  – Additional Scholarship for Teaching Assistantship
Degree Requirements

• MSc
  ▪ 7 technical elective courses + Seminar + MS Thesis + Research Methods and Academic Publication Ethics course

• PhD
  ▪ 7 technical elective courses + Seminar + Qual Exam + PhD Thesis + Journal Publication Research Methods and Academic Publication Ethics course
Graduates of MS Program

<table>
<thead>
<tr>
<th>Position</th>
<th>Count</th>
<th>%</th>
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<tbody>
<tr>
<td>PhD in Turkey</td>
<td>20</td>
<td>9.0%</td>
</tr>
<tr>
<td>Faculty in Turkey</td>
<td>37</td>
<td>16.7%</td>
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<tr>
<td>Engineer in Turkey</td>
<td>151</td>
<td>68.0%</td>
</tr>
<tr>
<td>Co-founder in Turkey</td>
<td>14</td>
<td>6.3%</td>
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<tr>
<td>PhD abroad</td>
<td>35</td>
<td>15.8%</td>
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<tr>
<td>PostDoc abroad</td>
<td>10</td>
<td>4.5%</td>
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<tr>
<td>Faculty abroad</td>
<td>20</td>
<td>9.0%</td>
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<tr>
<td>Engineer abroad</td>
<td>147</td>
<td>30.6%</td>
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<tr>
<td>Co-founder in abroad</td>
<td>9</td>
<td>4.1%</td>
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<tr>
<td>Unknown</td>
<td>37</td>
<td>7.7%</td>
</tr>
</tbody>
</table>

| In Turkey                     | 222   | 46.3%|
| Abroad                        | 221   | 46.0%|
| Unknown                       | 37    | 7.7% |
| Total:                        | 480   | 100.0%|
# Graduates of MS Program

## In Turkey
- Bilkent Univ. : 25
- ASELSAN : 20
- HAELSAN : 16
- TÜBİTAK : 13
- Hacettepe Univ. : 6
- METU : 6
- TSK : 5
- STM : 4
- TCMB : 4
- Vestel : 4
- Cybersoft : 3
- Garanti Teknoloji : 3
- MiISoft : 3
- OpsGenie : 3
- Sabancı Univ. : 3
- Akdeniz Univ. : 2
- Oracle : 2

## Abroad
- Microsoft : 23
- Google : 16
- Amazon : 6
- Booking.com : 4
- Case Western Reserve Univ. : 4
- Facebook : 4
- Univ. California : 4
- SAP : 3
- U. of Massachusetts Amherst : 3
- UBER : 3
- EPFL : 2
- ETH : 2
- Imperial College : 2
- Sandia National Labs. : 2
- U. of Texas at San Antonio : 2
- University of Florida : 2
- University of Waterloo : 2
- U. of Illinois at Urbana-Champaign : 1
- Washington U. in St. Louis : 1
## Graduates of PhD Program

<table>
<thead>
<tr>
<th>Position</th>
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<tr>
<td>Faculty in Turkey</td>
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<td>Engineer abroad</td>
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<tr>
<td>Co-founder in abroad</td>
<td>1</td>
<td>3.1%</td>
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- **In Turkey**: 36 (52.9%)
- **Abroad**: 32 (47.1%)
- **Total**: 68 (100.0%)
## Graduates of PhD Program

### in Turkey

<table>
<thead>
<tr>
<th>University</th>
<th>Count</th>
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<tr>
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<tr>
<td>Hacettepe Univ.</td>
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<td>Akdeniz University</td>
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<tr>
<td>Sabancı Univ.</td>
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<td>TED University</td>
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<tr>
<td>Ankara University</td>
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<td>Aselsan</td>
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<td>Atilım University</td>
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<tr>
<td>Beykent University</td>
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<tr>
<td>Çukurova Üniversitesi</td>
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<td>SAP</td>
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<td>TAI</td>
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<tr>
<td>TCMB</td>
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<td>Turkcell</td>
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### Abroad

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<td>Amazon</td>
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<tr>
<td>Oregon Health and Sci. U.</td>
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<tr>
<td>Case Western R. U.</td>
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<td>Lawrence Berkeley Lab</td>
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<td>LIP ENS-LYON CNRS</td>
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<td>ETH</td>
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<td>Fraunhofer</td>
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<td>Georgia Tech</td>
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<td>Google</td>
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<td>Microsoft</td>
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<td>Oracle</td>
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<td>Salesforce</td>
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<td>Sandia National Labs.</td>
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<td>Stony Brook University</td>
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<td>U. of Central Florida</td>
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<td>Uber</td>
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### Faculty Members

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<td>Georgia Institute of Technology</td>
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<td>Hacettepe University</td>
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<td>Konya Food &amp; Agriculture University</td>
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<td>METU</td>
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<td>Sabancı University</td>
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<td>Selçuk University</td>
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<td>TED</td>
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</table>
Faculty Members

• In alphabetic order

(Please contact with them in person for details.)
My current research is two pronged:

i. contextual reasoning in AI
ii. public implications of the Internet
Contextual reasoning in AI

Problems originating from natural language processing and understanding, especially those caused by the lack of explicit context:

When we say a particular thing, we do so in a context. Thus, there are embedded background assumptions available only through the context. We are also good at shifting between contexts. Can context be formalized in a formal framework? This would lead to improved software not only in Natural Language Understanding but also in knowledge-based systems, robotics, search engines, and personal assistants like Siri, Cortana, OK Google.

My grad courses CS 563 and CS 661 examine contexts, as well as other AI topics.
Public implications of the Internet

Problems caused by tensions between local versus global, individual versus corporate, and democratic versus authoritarian in the framework of the Internet. More specifically:

Basic concepts and history of the Internet as a socio-political medium. Free access to information in the networked world. The Internet as a trusted communications medium in light of security and privacy issues. Censorship and politics of the Internet vis-à-vis interventions by oppressive governments. Social movements in the 21st century marked by rapid broadcast of ideas and images.

My grad course CS 513 treats such societal aspects of the Internet.
Selim Aksoy
saksoy@cs.bilkent.edu.tr
http://www.cs.bilkent.edu.tr/~saksoy
Office: EA 422 (4th floor)

Research interests:
- Computer vision
- Pattern recognition
- Machine learning

Current topics:
- Medical image analysis
- Remote sensing image analysis
- Image classification
- Object recognition
- Content-based image retrieval
Sponsored Research Projects

- **Medical image analysis**
  - TÜBİTAK 1001, 2018-2021
  - TÜBİTAK 1001, 2014-2017
  - TÜBİTAK CAREER Grant, 2005-2010

- **Remote sensing image analysis**
  - TÜBİTAK 1001, 2010-2012
  - European Commission, Joint Research Centre, 2008-2009
  - TÜBİTAK CAREER Grant, 2005-2010
  - FP6 Marie Curie Grant, 2005-2007

- **Image and video mining**
  - DPT, 2004-2005

Dr. Selim Aksoy
Medical Image Analysis

Segmentation and classification of cervical cells

Classification of prostate biopsies

Content-based search of medical archives

Dr. Selim Aksoy
Medical Image Analysis

Whole slide imaging
(100,000 x 100,000 pixels, 30 GB/image)

Deep networks for region of interest detection

Different weakly supervised learning scenarios

Dr. Selim Aksoy
Medical Image Analysis

- Convolutional neural networks for region of interest classification
- Deep feature representations
- Conditional random fields for weakly supervised learning
- Convolutional neural networks for region of interest classification
- Computer aided diagnosis of breast biopsies

Dr. Selim Aksoy
Remote Sensing Image Analysis

Increasing spatial resolution (300m $\Rightarrow$ 1-2cm)

Hyperspectral image analysis

Orchard segmentation and agricultural mapping

Multi-source fusion and missing data analysis

Dr. Selim Aksoy
Remote Sensing Image Analysis

Zero-shot learning for object recognition

Geospatial data mining

Attention model for multi-source fine-grained object recognition

Dr. Selim Aksoy
Can Alkan
calkan@cs.bilkent.edu.tr
Lab for Bioinformatics and Computational Genomics
http://www.cs.bilkent.edu.tr/~calkan/compgen

Combinatorial algorithms to analyze high throughput sequence data to discover, genotype, and phase genomic variants, assemble genomes and transcriptomes.

Test genome

Random shearing and Size-selection

Paired-end sequencing

Resequencing

Reference Genome

Read mapping and variation analysis

De novo sequencing

Contigs/Scaffolds

Assembly
Types of genomic variants

SNP: Single nucleotide polymorphism (substitutions)
Indel: Insertions and deletions of sequence of length 1 to 50 basepairs

**reference:**
\[
\text{C A C A G T G C} \quad \text{G C - T}
\]

**sample:**
\[
\text{C A C C G T G - G C A T}
\]

**SNP**  **deletion**  **insertion**

**Short tandem repeats:** microsatellites, minisatellites, alpha & beta satellites, etc.

**reference:**
\[
\text{C A G C A G C A G C A G C A G C A G}
\]

**sample:**
\[
\text{C A G C A G C A G C A G C A G C A G}
\]

**Structural variation:** Genomic alterations > 50 bp
Deletions, insertions, mobile elements, duplications, inversions and translocations
Genome sequencers

- Roche/454
- AB SOLiD
- Illumina HiSeq2000
- Pacific Biosciences RS
- Ion Torrent PGM
- Ion Torrent Proton
- Oxford Nanopore MinION
- Oxford Nanopore GridION

... and more! All produce data with different properties.
Selected publications


**Combinatorial algorithms for structural variation detection in high throughput sequenced genomes.** Genome Research, Jul, 19(7):1270-8, 2009.


**A draft sequence of the Neandertal genome** Science, 7 May, 328 (5979):710-722, 2010.
  *Recipient of the 2010 AAAS Newcomb Cleveland Prize.*


**Limitations of next-generation genome sequence assembly.** Nature Methods, 8(1):61-65, 2011.


Projects

- Discovery and characterization of genomic variation
  - Funded by EU Marie Curie Actions Career Integration Grant
- Algorithms and hardware designs for ultra-fast mapping of HTS reads to reference genome assemblies
  - Funded by US National Institutes of Health
- De novo and hybrid (multi-platform) sequence assembly.
- Genomic repeat discovery, classification and annotation.
- Distributed algorithms for genome assembly.

Positions available. Contact if you have B.Sc. or M.Sc. degree in computer science, computer engineering, electrical engineering, or mathematics, and if you are interested in combinatorial optimization, approximation algorithms, and graph theory. Strong programming skills in C/C++ are highly desired.

Successful applicants will also have a chance to contribute to many international consortiums such as the 1000 Genomes Project and the Genome 10K, and will involve in other international collaborations with researchers in Vancouver, Seattle, Barcelona, Bari, Pittsburgh, and more.

Basic understanding of biology/genetics/genomics is a plus, but not required.
### Shervin Rahimzadeh Arashloo

s.rahimzadeh@cs.bilkent.edu.tr  
www.cs.bilkent.edu.tr/~s.rahimzadeh  
Office: EA 429

<table>
<thead>
<tr>
<th>Research Interests</th>
<th>Current Research Topics</th>
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<tbody>
<tr>
<td>• Computer Vision</td>
<td>• Face Recognition</td>
</tr>
<tr>
<td>• Pattern Recognition</td>
<td>• Face Presentation Attack Detection</td>
</tr>
<tr>
<td>• Machine Learning</td>
<td>• Anomaly Detection</td>
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</table>
Unconstrained Face Recognition
Face Presentation Attack Detection

Securing face recognition systems against security threats made by fake biometric traits
Anomaly Detection

Developing novel methodologies along with applications to:

Surveillance
Novelty detection
Healthcare

etc.
Bilkent University
High Performance Computing (HPC)

Recent research interest and expertise

- Combinatorial scientific computing
- Iterative solvers: novel partitioning models, algorithms and software utilities for development of parallel iterative methods for linear-system solutions
- Optimizing latency-centric communication metrics for petascaling sparse solvers
- Partitioning irregular domains for large-scale parallel processing
- Locality aware scheduling of irregular applications on Many Core architectures
- Partitioning models for scaling 1D-, 2D- and 3D-parallel sparse matrix-matrix multiply
- Partitioning large scale social networks and graph databases
- Parallel graph analytics kernels for big data applications

- HPC for Machine Learning and ML for HPC
- Partitioning methods for scalable sparse Tensor decomposition
- Scaling parallel stochastic gradient descent algorithms for ML
- Fast and efficient model parallelism for Deep CNNs
- Task leader in FP7 / Horizon2020 PRACE projects: 1IP, 2IP, 3IP, 4IP, 5IP

Speedup curves of Conjugate Gradient solver for different methods on a Cray and BlueGene/Q machine
(kkt-power matrix: 2 million rows, 12 million nonzeros)
Recent Publications (2018-2020)

- Reordering Sparse Matrices into Block-Diagonal Column-Overlapped Form, *Seher Acer and Cevdet Aykanat*, *Journal of Parallel and Distributed Computing*, accepted for publication.


Recent Funded Projects

- **TUBITAK/COST Projects**
  - 119E035: Parallel Stochastic Gradient Descent Algorithms for Large-Scale Recommendation Systems, 1/7/2019 - 31/12/2021
  - 116E043: High Performance Tensor Decomposition Methods for Distributed and Shared Memory Parallel Systems, 01/05/2017 – 1/11/2019
  - 115E212/COST-CA15109: Improving Sparse Matrix Based Graph Analytics Kernels for Big Data Applications, 01/09/2015 - 01/03/2018
  - 114E545/COST-IC1406: Petascaling Sparse Iterative Solvers via Optimizing Multiple Communication Metrics, 01/04/2015 - 01/10/2017
  - 112E120: Partitioning, Replication and Query Processing in Social Networks, 01/09/2012 - 01/09/2014

- **FP7/HORIZON-2020 Projects**
  - PRACE 6IP 01/05/2019 – 01/05/2021
    - Task 7.4: Evaluation of Benchmark Performance
  - PRACE 5IP 01/01/2017 – 01/05/2019
    - Task 7.2: Preparing for PRACE Exascale Systems
  - PRACE 4IP 01/02/2015 - 01/05/2017
    - Task 7.2: Preparing for Future PRACE Exascale Systems
  - PRACE 3IP 01/08/2012 - 01/08/2014
    - D7.2.1 HPC Tools and Techniques
  - PRACE 2IP 01/07/2011 - 01/07/2014
    - D12.5 Summary of Novel Programming Techniques Results (Taskleader)
  - PRACE 1IP-Extension 01/07/2013 - 01/07/2014
    - D7.1.3 Application Enabling for Capability Science in the MICArchitecture
  - PRACE 1IP 01/07/2010 - 01/07/2013
    - D7.5 HPC Programming Techniques (Task leader)

Contact Address:
Prof. Cevdet Aykanat
aykanat@cs.bilkent.edu.tr
Current Positions of Some Former PhD. Students

- Dr. Seher Acer, 2017. Sandia National Lab., Postdoc
- Dr. Oguz Selvitopi, 2017. Lawrence Berkeley National Lab., Postdoc
- Dr. Şükrü Torun, 2017. Yıldırım Beyazıt University, Assistant Professor
- Dr. Kadir Akbudak, 2015. KAUST, Postdoc
- Dr. Enver Kayaaslan, 2013. Google Switzerland, Researcher
- Dr. Ertuğrul Tabak, 2013. Aurea Software, Software engineering manager
- Dr. Eray Özkural, 2013. Celestial Intellect Cybernetics, Software engineer
- Dr. Tayfun Küçükyılmaz, 2012. TED University, Assistant Professor
- Dr. Ata Türk, 2010. Boston University, Postdoc
- Dr. Engin Demir, 2009. Hacettepe University, Assistant Professor
- Dr. Barla Cambazoğlu, 2006. RMIT University, Senior research fellow
- Dr. Bora Uçar, 2005. LIP ENS-LYON, CNRS researcher.
- Dr. Ümit Çatalyürek, 1999. Georgia Institute of Technology, Professor
- Dr. Tahsin Kurc, 1997. Stony Brook University, Associate Professor
Bilkent Information Retrieval Group

**Faculty**
Fazlı Can  
Seyit Koçberber

**Graduate Students**
Sepehr Bakhshi  
Alican Büyükçakır  
Sevil Çalışkan  
Sanem Elbaşı  
Pouya Ghahramanian  
Ömer Gözüaçık  
Aykut Güven

**UG Student(s)**
Taha Aksu

**Some Prev. Members**
Cem Aksoy  
Ahmet Buğdaycı  
Hayrettin Erdem  
Cem Karbeyaz  
Süleyman Kardaş  
Cihan Kaynak  
H. Çağdaş Öcalan  
Anıl Türel  
İbrahim Uysal

**Other Contributors**
Hamed R. Bonab, UMass  
Dilek Küçük, TÜBİTAK  
Çağrı Toraman, UCF
Research Interests

Information Retrieval (IR)

- Information Filtering
- News Aggregation and Categorization
- Turkish Text Mining

• Data Stream Mining
  - Ensemble Models for Stream Classification
  - Multi-label Classification
  - Concept Drift Detection
  - Multi-stream Processing
  - Stance Detection
You are the right person for our group

• If you are good at four core practices of computer science
  • programming,
  • systems thinking,
  • modeling, and
  • innovation.

• If you
  • can dream,
  • can do, and
  • can write.
My research focuses on building algorithms for analyzing biological data using various biochemical networks. Even though it took 13 years and ~$1b to sequence the first genome, right now, it takes a day and ~$1k. This has resulted in accumulation of vast amounts of information. Consequently, biosciences have faced the problem of “big data”. Today, the bottleneck in the bio-research is the lack of computational power and algorithms that can efficiently analyze the data and make discoveries. Central dogma in molecular biology dictates the information flow from DNA -> RNA --> Protein --> Metabolite. Each layer introduces 20k, 100k, 1m, and 3k variables respectively. The search space for even a basic pattern discovery is clearly intractable. I design machine learning algorithms that use biological networks to prune the search space and discover biomarkers in particular for genetic Diseases.
Gene Discovery for Autism Spectrum Disorder

- Broken interplay between 1000 genes lead to autism.
- So far we have only discovered ~50 of them, Biological networks along with intelligent search algorithms needed to discover new genes to understand the genetic architecture.
Using Dynamic Network Algorithms to Model Autism

- We design algorithms to early childhood networks to understand the development of the fetal period and how developmental disorder affects autism.
Metabolic Networks to Understand Cancer

Metabolites are the small compounds in the body and have been found to be key biomarkers to define certain tumors. We use network algorithms and build online systems that analyze metabolic signatures in tumors and understand the differences within the subtypes of the same cancer.
Selected Publications:

- De Novo Chip-Seq Analysis. Genome Biology 2015, 16:205.
I work in the fields of Affective Computing, Computer Vision, and Pattern Recognition.

My current research mainly focuses on multimodal analysis of non-verbal human behavior (e.g. face analysis, gesture recognition, etc.) and deep learning of temporal representations.
Assessment of Depression Severity

dibeklioglu@cs.bilkent.edu.tr | http://www.cs.bilkent.edu.tr/~dibeklioglu/
Kinship Verification
Age Estimation through Facial Dynamics
Facial Expression Recognition

- Angst: 65%
- Verrassing: 30%
- Walging: 5%
- Disgust:
Selected Publications

i-Vis @ Bilkent
Information Visualization Research Lab at Bilkent University

Big data visualization & analytics, Pathway visualization & informatics, Graph drawing & layout, Graph database querying algorithms

Ugur Dogrusoz

Click here for live/animated version
Example Applications

- Understanding human metabolism and disease conditions through biological pathway analysis
- Identifying fraud in financial networks
- Management and monitoring of computer networks
- Understanding how people behave and collaborate online to improve web sites through social network analysis
- Detecting and monitoring of terrorist or criminal networks via telecommunication network analysis

Graph Queries

- Access database to get a “graph/network of interest” from “nodes of interest”

- Graph algorithms
  - Shortest paths
  - Neighborhoods
  - Common targets / sources
  - Centrality
  - Often requires variations (e.g. shortest + k length paths)

Dogrusoz et al., Algorithms for Effective Querying of Compound Graph-Based Pathway Databases, BMC Bioinformatics, 2009
Automatic Graph Layout

Automatic layout of compound / nested graphs

Automatic layout of clustered / grouped graphs


Complexity Management

Hide-show: hide currently non-interesting parts and reveal on demand

Expand-collapse: collapse groups / clusters to later expand on demand


Evolving Networks

Time based filtering and animation
Software Highlights

Pathways simplified: View, design, and analyze pathways in SBGN...


i-Vis @ Bilkent
Software Highlights

PathwayMapper

pathwaymapper.org & cbiportal.org

Collaborative pathway curation tool for interactive creation, editing, and sharing of cancer pathways


Software Highlights

cbioportal
cbioportal.org

Visualization, analysis, and download of large-scale cancer genomics data sets

Gao, Aksoy, Dogrusoz et al., "Integrative analysis of complex cancer genomics and clinical profiles using the cBioPortal", Science Signaling, 6(269), pl1, 2013.

Software Highlights

**Visuall**

A proprietary software library used by companies for commercial purposes. A library to jump start software developers in building a visual web based component for analysis of relational information.
Software Highlights: complexity management

https://js.cytoscape.org/#extensions

Generic plugins for Cytoscape.js used by many to build commercial and non-commercial visualization software

27 ★ cytoscape.js-viewUtilities:
hide/show, highlight, zoom

52 ★ cytoscape.js-expand-collapse: manage complexity with expand-collapse
Software Highlights: automatic layout

https://js.cytoscape.org/#extensions

Generic plugins for Cytoscape.js used by many to build commercial and non-commercial visualization software

67★ cytoscape.js-cose-bilkent: compound graph layout

3★ cytoscape.js-cise: clustered graph layout

3★ cytoscape.js-avsdf: circular layout

3★ cytoscape.js-layout-utilities: placement of new nodes and polyomino packing of components

11★ cytoscape.js-fcose: fast compound graph layout
Software Highlights: graph editing

https://js.cytoscape.org/#extensions

Generic plugins for Cytoscape.js used by many to build commercial and non-commercial visualization software

24★ cytoscpe.js-grid-guide: grid and guidelines for convenient placement of nodes

25★ cytoscpe.js-undo-redo: undo/redo of graph editing operations

8★ cytoscpe.js-edge-editing: reconnection and rerouting of edges

11★ cytoscpe.js-node-resize: interactive resizing of nodes
Software Highlights: miscellaneous

https://js.cytoscape.org/#extensions

Generic plugins for Cytoscape.js used by many to build commercial and non-commercial visualization software

19★ cytoscape.js-graphml:
bi-directional conversion between graphml and Cytoscape.js

38★ cytoscape.js-context-menus:
context-sensitive menus on graph objects

7★ cytoscape.js-autopan-on-drag:
automatic panning on drag out of drawing canvas
Contact

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https://twitter.com/ivisatbilkent
https://github.com/iVis-at-Bilkent

Click here for live/animated version
Digital pathology: classification and segmentation in biopsy images

End-to-end segmentation in biopsy images

Gland/cell segmentation in colon tissues

High-level representation of histopathological images and colon cancer classification

CT and MR image analysis for in vivo images

Subcutaneous tumor segmentation

Cartilage endplate segmentation

High content screening: cell segmentation in microscopic images

Cell segmentation in phase contrast microscopy

Cell segmentation in fluorescence microscopy

Cell segmentation in peripheral blood and bone marrow images
Deep Learning for Medical Image Analysis
Digital Pathology

Unsupervised feature extraction via deep neural networks for histopathological image representation and classification

End-to-end gland and tissue segmentation using fully convolutional networks
Deep Learning for Medical Image Analysis

Cell Segmentation

Multi-task models for cell detection in live cell microscopy

Two-stage convolutional neural networks for cell nucleus segmentation in tissue images
Computer Graphics
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gudukbay@cs.bilkent.edu.tr

Research Topics:
1. Augmented and Virtual Reality
2. Terrain and Urban Modeling and Visualization
3. Human Modeling and Animation
Augmented and Virtual Reality

- Crowd Simulation
- Realistic Lighting
- Camera Registration and Tracking
- Augmented Reality on Mobile Devices
Terrain and Urban Modeling and Visualization

- Level-of-detail management
- View-dependent refinement
- Stereoscopic visualization
- GPU-based tessellation
- Crowd simulation in urban environments
Human Modeling and Animation
Machine Learning and Data Mining

Current research topics include Learning to

- rank instances
- model risk factors
- estimate risks
- suggest to increase success

Application areas: Medical, Social Networks
Networks and Systems Research Group
Bilkent University – Department of Computer Engineering

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Working on Problems and Projects related with Computer Networks and Computer Systems

Research Areas:
- Computer Networks
- Computer Systems
- Network and Distributed Algorithms
- Wireless Networks
- Distributed Systems
- Cloud Computing
- P2P Networks
- Sensor Networks
- Internet of Things
- WiFi and Bluetooth
- Big Data Systems
Networks and Systems Research Group

Sample Funded Projects

- Efficient Resource Allocation in Heterogeneous Cloud Infrastructures
  Sponsor: TUBITAK

- Supporting Real-time Traffic in Wireless Ad Hoc and Sensor Networks
  Sponsor: TUBITAK

- Bluetooth Scatternet Construction and Bluetooth Applications
  Sponsor: TUBITAK

- Network Middleware for Environmental Monitoring and Control with Wireless Ad hoc, Mesh and Sensor Networks
  Sponsor: IBM Corporation

- Intel WCNC, Wireless Networking Curriculum Enhancement Project
  Sponsor: Intel Corporation

- FIRESENSE Fire Detection and Management through a Multi-Sensor Network for the Protection of Cultural Heritage Areas from the Risk of Fire and Extreme Weather Conditions
  Sponsor: European Commission FP7 Programme, ENV

- Network of Excellence in Wireless Communications (NEWCOM and NEWCOM++)
  Sponsor: European Commission FP7 Programme, ICT
Wireless Mesh Networks
- Routing
- Channel assignment
- Interference modeling
- Interference mitigation

Testbeds

Cloud Computing
- Resource allocation
- VM placement
- Network virtualization
- Network embedding

Sensor Networks
- Energy efficient routing
- Activity scheduling
- Channel access scheduling
- ZigBee wireless technology
- ZigBee routing

P2P Networks
- Query forwarding
- Free riding
- File sharing and lookup

Delay tolerant networks
- Routing and Scheduling
Hidayet Aksu, Mustafa Canim, Yuan-chi Chang, Ibrahim Korpeoglu, Ozgur Ulusoy, *Distributed k-Core View Materialization and Maintenance for Large Dynamic Graphs*, IEEE Transactions on Knowledge and Data Engineering, 2014.


High-Performance and Energy Efficient Computing

*Algorithms, Systems, and Applications*

- Collaborative Filtering
- Graph Analytics
- PageRank
- Scientific Computing

- FPGAs
- GPUs
- Xeon Phi
- Parallel Systems
- Novel Architectures
Mustafa Ozdal
www.cs.bilkent.edu.tr/~mustafa.ozdal

Active projects:
• Energy efficient FPGA accelerators for big data applications (*supported by European Commission, in collaboration with Intel, Oregon*)
• Parallelizing Collaborative Filtering algorithms for recommender systems
• Parallel and vectorized scientific computing algorithms
• Optimizing memory architecture for graph analytics applications for large datasets.

I am interested in graduate student candidates who have one or more of the following:
• Strong algorithmic background and analytical skills
• Interest in solving programming puzzles
• C++ programming skills
• Experience with multi-core, GPU, and/or FPGA programming

For more information, see [www.bilkent.edu.tr/~mustafa.ozdal](http://www.bilkent.edu.tr/~mustafa.ozdal). You can send an email to mustafa.ozdal@cs.bilkent.edu.tr to set up an appointment.
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URL: http://www.cs.bilkent.edu.tr/~ozturk

- **Computer architecture** - memory scheduling, memory hierarchy design, metrics to consider energy, performance, reliability....
- **Multicore/Manycore architecture** - design of multicore systems, application mapping, data mapping, communication
- **Heterogeneous computing** - heterogeneous multicore design, core and cache selection, application execution
- **Parallel programming/systems/applications** - OpenMP, MPI, GPGPU, application characterization, automatic parallelization, scheduling
- **Cloud computing** - at the system level and architectural optimizations, heterogeneity aware scheduling
- **Embedded computing** - energy, performance, ...
- **Compiler optimizations** - code modifications and optimizations to generate better applications
Current Projects

- Heterogeneous Multicore Design
  *Funding: EC FP7*

- Parallelization for Heterogeneous Multicore Architectures
  *Funding: IBM*

- Utilizing Accelerator Technologies in the Cloud
  *Funding: Türk Telekom*

- Parallelizing Data Mining applications using GPUs
  *Funding: Nvidia*

- Accelerator Design for Graph Parallel Applications
  *Funding: Intel*
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Research Areas
- Software Analytics
- Software Product Line Engineering
- Gamification / Serious Games
- Software Engineering Education
- Software Development Processes
- Empirical Software Engineering
- Software Analytics

Interested in being part of our research group? Please contact us at eraytuzun@cs.bilkent.edu.tr

Bilkent University Software Engineering and Data Analytics Research Group (BILSEN)
https://bilsengroup.github.io
“practice offering software practitioners (not just developer) up-to-date and pertinent information to support their daily decision-making processes and Software Intelligence should support decision-making processes throughout the lifetime of a software system”

Ahmed E. Hassan and Tao Xie

Programmers who changed this function also changed
Don’t program on Fridays
Which files are more likely to be buggy?
**Gamification** is the use of game mechanics to drive engagement in non-game business scenarios and to change behaviors in a target audience to achieve business outcomes.
Selected Publications

- *An Auction-Based Serious Game for Bug Tracking*, Cagdas Usfekes, Eray Tuzun, Murat Yılmaz, Yagup Macit, Paul Clarke, IET Software, 2019
- *Adopting Augmented Reality for the Purpose of Software Development Process Training and Improvement: An Exploration*, İpek Ohri, İrem Öge, Bora Orkun, Murat Yılmaz, Eray Tüzün, Paul Clarke, RV O’Connor, European Conference on Software Process Improvement, 195-206
- *Adopting the Essence Framework to Derive a Practice Library for the Development of IoT Systems*, Gökrem Giray, Bedir Tekinerdogan, Eray Tüzün, Connected Environments for the Internet of Things, Challenges and Solutions, Springer International Publishing, 2018 (Book Chapter)
Database Research
Özgür Ulusoy
http://www.cs.bilkent.edu.tr/~oulusoy/

- Web Databases and Search Engines
- Multimedia Databases
- Big Data and Social Network Analysis
Web Databases and Search Engines

- Social Web search and personalization
- Domain-specific search engines
- Efficiency and scalability issues for Web Search Engines (caching, index pruning)
- Web information extraction
- Modeling and querying of Web resources
- XML querying & searching

Search Engines are the key to access Web Data

1995
S. Brin meets L. Page

1998
Birth of Google

1999-2004
The world’s largest!
First billion-URL index
≈5000 PCs in clusters!

2004
Index grows to 4.2 billion pages

2008
Google counts 1 trillion unique URLs

2009
TBs or PBs of data/index
Tens of thousands of PCs

2009
Efficient and scalable strategies are of vital importance!

2010
The size of the indexed World Wide Web (Number of webpages)

2015
Google counts 1 trillion unique URLs
Multimedia Databases
(joint work with Prof. Uğur Güdükbay)

- Video Retrieval Systems
- Mobile Visual Search
- Ottoman Archive Content-Based Retrieval System

BilVideo: Integrated video DBMS supporting low-level, spatio-temporal, motion and semantic querying of videos

**SPATIO-TEMPORAL QUERY GUI**

**SEMANTIC QUERY GUI**

**TRAJECTORY QUERY GUI**

**SYSTEM ARCHITECTURE**
BilVideo-7: An MPEG-7 Compatible Video Retrieval System

**Web Client**

**Visual Query Interface**

**Raw Video Database** (File System)

**Video Processing**
- SBD, Segmentation
- Object Extraction
- Annotation
- etc.

**XML-Native Feature Database** (Tamino)

**Query Processor**

**Feature Extraction**
- MPEG-7 Features

**Automatic processing:** segmentation, tracking, feature extraction, annotation, indexing

Powerful querying capability for video data
- keyword and content-based queries
- spatio-temporal object queries

Example query formulation:
- Salient video object extraction
- **putin**
- **bush**
- **dog**

**Raw Video**

**Keywords:** trees, greenery, sky – bush, putin, dog
Mobile Image Search Using Multi-Image Queries

Workflow of the Search System

Early and Late fusion methods

Single (a) and multi-view queries and corresponding result lists using early (b) and late (c) fusion methods.
Big Data and Social Network Analysis

Social Network Data Analysis on Big Data Processing Platforms

- Development, implementation and evaluation of algorithms/methods to process/analyze social network data for various social network problems. (joint work with Prof. İbrahim Körpeoğlu)