Class Schedule - Fall 2017

Electrical and Computer Engineering

ECE 598  Special Topics in ECE  credit: 0 TO 4 hours.
Subject offerings of new and developing areas of knowledge in electrical and computer engineering intended to augment the existing curriculum. See Class Schedule or departmental course information for topics and prerequisites. May be repeated in the same or separate terms if topics vary.

<table>
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<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
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<th>Location</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>68328</td>
<td>Lecture</td>
<td>IW</td>
<td>02:00 PM - 03:20 PM</td>
<td>TR</td>
<td>4070 - Electrical &amp; Computer Eng Bldg</td>
<td>Ilie, R Waldrop, L</td>
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Credit Hours: 4 hours
Solar System Electrodynamics
Restricted to Graduate - Urbana-Champaign.
Fundamental electrodynamic processes in space environments. Prerequisites: ECE 350. Lectures and discussion related to fundamental processes important in space sciences including space plasma physics and space weather. Topics include: (i) fundamental plasma physics and kinetic theory; (ii) physics of the generation and transport of solar wind plasma, (iii) plasma convection and current systems in the earth’s magnetosphere; (iv) electrodynamic processes in the earth’s ionosphere, including waves and plasma instabilities; and (v) the dynamical coupling between the solar wind, the magnetosphere, and the ionosphere.

| 68324| Lecture  | KH      | 02:00 PM - 03:20 PM | TR   | 2013 - Electrical & Computer Eng Bldg | Haran, K      |

Credit Hours: 4 hours
Topics in Electromechanics
Restricted to Graduate - Urbana-Champaign.
Prerequisites: ECE 431 –Electric Machinery. Technologies, such as advanced materials, manufacturing processes and power electronics, open up the design space to new electrical machine solutions for emerging applications in the transportation, energy, and industrial sectors. To take full advantage of these developments, engineers need to be well versed in the multi-disciplinary design process of electrical machines, with a good understanding of and insights into the complex trade-offs across various attributes and performance metrics. Engineers must have knowledge of both analytical and numerical approaches/tools and understand their appropriate and effective applications. This course provides the needed analytical and computational background and prepares electrical and mechanical engineers to undertake innovative electrical machine design. The emphasis is on the incorporation of practical design considerations from all the relevant disciplines. The course reviews the fundamental principles of energy conversion applicable to all types of electric machinery and takes students through the design of various electromechanical devices. Basic design rules, analytical formulae and the use of numerical design tools are covered and experience is gained through two hands-on design projects. As the only graduate course in electrical machines the projects undertaken provide the appropriate training of future machine designers. As such, the scope and nature of the projects require knowledge and judgment of students at the graduate level.

| 66386| Lecture  | NS      | 11:00 AM - 12:20 PM | MW   | 2074 - Electrical & Computer Eng Bldg | Shanbhag, N |

Credit Hours: 4 hours
Machine Learning in Silicon
Restricted to Graduate - Urbana-Champaign.
Prerequisites: ECE 313, and ECE 482. This course will introduce the design and implementation of robust and energy-efficient machine learning systems on nanoscale CMOS, with applications to emerging sensor-rich energy-constrained embedded platforms such as wearables, IoTs, autonomous vehicles, and biomedical devices. Algorithm-to-architecture mapping techniques to reduce energy consumption will be studied and applied to machine learning algorithms to optimize energy. Energy, delay and behavioral models of machine learning kernels in nanoscale silicon operating at the limits of energy efficiency (low-SNR fabrics) will be developed, and the impact of errors due to low-SNR circuit operation on system behavior studied. Statistical Shannon-inspired error compensation techniques based on estimation and detection techniques will be discussed and compared with conventional fault
tolerance and error resiliency techniques. Case studies of integrated circuit realizations of machine learning kernels in silicon will be presented.

| 68325 | Lecture | PV | 12:30 PM - 01:50 PM | TR | 2017 - Electrical & Computer Eng Bldg | Viswanath, P |

Credit Hours: 4 hours
Learning: Algorithms & Models
Restricted to Graduate - Urbana-Champaign.
Prerequisites: ECE 534. Learning to represent real-world data, from images to text to proteins, is a basic scientific endeavor of great topical interest. Many of these data elements are naturally discrete (example: words) and are readily modeled as discrete atomic units; however this is unable to capture the relation between the discrete units. On the other hand, distributional real vector-valued representations provide a geometric backdrop to describe relations between units. Such representations have been the key behind success of several machine learning algorithms, especially when related to natural language data. Successful examples include LSA (latent semantic analysis) for (coarse) text/document representation and very recently, Word2Vec for (fine grained) representation of words. Word2Vec has been extremely successful in a variety of natural language processing applications: The success comes from the geometry of the representations that efficiently captures linguistic regularities: the semantic similarity of words are well captured by the similarity of the corresponding vector representations; the latent relation between two words is well captured by the difference vector between the corresponding two vector representations. In this course, we take a first principles view of the key mathematical ideas behind the major representation learning algorithms of machine learning. The topics covered range from classical ones (viewing classical representation learning algorithms of PCA and CCA as maximum likelihood rules under suitable probabilistic models) to very recent ones (word2vec and its variants for learning representations of words).