Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Computer Science | Alpha Designator/Number: CS 505 | (•) Graded ( ) CR/NC

Contact Person: Venkat N Gudivada | Phone: 304 - 696 - 5452

NEW COURSE DATA:

New Course Title: Computing for Bioinformatics

Alpha Designator/Number: C S 5 0 5

Title Abbreviation: Comput for Bioinformatics

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

Study of computational algorithms and programming techniques for various bioinformatics tasks including parsing DNA files, sequence alignments, tree construction, clustering, species identification, principal component analysis, correlations, and gene expression arrays.

Co-requisite(s): None | First Term to be Offered: Spring 2014

Prerequisite(s): None | Credit Hours: 3.0

Course(s) being deleted in place of this addition (*must submit course deletion form*): None

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date 12-March-2013
Registrar 110101	Date 3/12/13
College Curriculum Chair	Date 4/10/13
Graduate Council Chair	Date 5/23/13

Request for Graduate Course Addition - Page 2

College: CITTE | Department/Division: Computer Science | Alpha Designator/Number: CS 505

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

Jonathan Thompson, Paulus Wahjudi, Venkat Gudivada

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Existing Marshall University BigGreen supercomputer is adequate for the proposed course. No additional resources are required.

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Please see attached syllabus document.

7. COURSE OUTLINE (May be submitted as a separate document)

Please see attached syllabus document.

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Please see attached syllabus document.

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture, lab, design and programming problems.

Request for Graduate Course Addition - Page 4

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Design and programming assignments, midterm exam, final exam.

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

Not Applicable

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

See attached syllabus document.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Weisberg Division of Computer Science

Course Number and Title: CS 505: Computing for Bioinformatics

Catalog Description: Study of computational algorithms and programming techniques for various bioinformatics tasks including parsing DNA files, sequence alignments, tree construction, clustering, species identification, principal component analysis, correlations, and gene expression arrays.

Prerequisites: None

First Term Offered: Spring 2014

Credit Hours: 3.0

Marshall University Syllabus

Course Title/Number	Computing for Bioinformatics/ CS 505
Semester/Year	Fall/2014
Days/Time	TR /3.30 - 4.45 PM
Location	GH 211
Instructor	Venkat N Gudivada
Office	GH 207A
Phone	304 - 696 - 5452
Email	gudivada@marshall.edu
Office/Hours	MWF 10.00 - 12.00 Noon
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment.

1 Course Description: From Catalog

Study of computational algorithms and programming techniques for various bioinformatics tasks including parsing DNA files, sequence alignments, tree construction, clustering, species identification, principal component analysis, correlations, and gene expression arrays.

2 Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Course Student Learning Outcomes	How **students will practice each outcome** in this Course	How **student achievement of each outcome will be assessed** in this Course
Students will **be able to effectively search and retrieve** bioinformatics data from various biodatabases and repositories using open source tools	In-class search and retrieval exercises, and guided discussions	Programming assignments
Students will **be able to demonstrate their understanding of computational algorithms** used for various bioinformatics tasks	In-class exercises, and guided discussions	Algorithm design and analysis assignments, and exams
Students will **be able to implement computational algorithms for bioinformatics tasks** using Python programming language	In class programming exercises	Programming assignments, and exams
Students will **be able to solve bioinformatics problems** by identifying relevant algorithms, suitably transforming data for algorithms application, analyze, visualize, and interpret results	In-class exercises, and guided discussions	Programming assignments, and exams

3 Required Texts, Additional Reading, and Other Materials

Required Text

[1] Steven Haddock and Casey Dunn. *Practical Computing for Biologists.* Sinauer Associates, Inc., 2010.

Web Resources

① Little Book of R for Bioinformatics

② Little Book of R for Biomedical Statistics

③ Little Book of R for Time Series

Additional Reading

[1] Andreas D. Baxevanis and B. F. Francis Ouellette. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins.* Wiley-Interscience, 2004.

[2] Jean-Michel Claverie and Cedric Notredame. *Bioinformatics For Dummies.* John Wiley, 2006.

[3] Sumeet Dua and Pradeep Chowriappa. *Data Mining for Bioinformatics.* Chapman & Hall/CRC, 2012.

[4] Philipp K. Janert. *Data Analysis with Open Source Tools.* Sabestopol, CA: O'Reilly Media, 2010.

[5] Jason Kinser. *Python For Bioinformatics.* Jones and Bartlett, 2009.

[6] Bradley N. Miller and David L. Ranum. *Python Programming in Context.* Second Edition. Jones and Bartlett, 2013.

[7] Mitchell L. Model. *Bioinformatics Programming Using Python: Practical Programming for Biological Data.* O'Reilly Media, 2009.

[8] Jonathan Pevsner. *Bioinformatics and Functional Genomics.* Wiley-Blackwell, 2009.

[9] Tore Samuelsson. *Genomics and Bioinformatics: An Introduction to Programming Tools for Life Scientists.* Cambridge University Press, 2012.

[10] Marketa Zvelebil and Jeremy Baum. *Understanding Bioinformatics.* Garland Science, 2007.

4 Course Schedule

- Week 1 - 2
  - Linux basics
  - Python programming language
  - Algorithms and data structures
- Week 3
  - Searching and retrieving bioinformatics data
- Week 4
  - Parsing DNA files
- Week 5
  - Similarity searching and sequence alignments
- Week 6
  - Phylogenetic tree construction
- Week 7 - 8
  - Clustering
  - Species identification
- Week 9 - 10
  - Principal component analysis

- Midterm exam
- Week 11
  - Self-organizing maps
- Week 12
  - Correlations
  - Fourier transforms
- Week 13 - 14
  - Gene expression arrays
- Week 15
  - Final exam

5 Course Requirements/Due Dates

Activity/Deliverable	Due Date
Midterm exam	October, 14
Final exam	December, 9

6 Grading Policy

Activity	Weight
Algorithm design assignments	20%
Programming assignments	30%
Midterm exam	20 %
Final exam	30%

Course grade is awarded based on the following scheme:

Score	Letter Grade
>= 90	A
>= 80 & < 90	B
>= 70 & < 80	C
>= 60 & < 70	D
< 60	F

7 Attendance Policy

Attendance will be taken at the start of class. Only university excused absences will be accepted.

8 Classroom Etiquette

- Students are expected to show up for class on time and remain in the class for the entire duration of the class.
- Students are not allowed to use personal laptops during the lecture part of the class.
- All types of phones and personal digital assistants must be turned off or put in silent mode during lectures.
- While taking tests, all types of electronic gadgets including cell phones, iPhones, iPod touch, blackberries, laptops must be turned off. No internet browsing is allowed during test taking.

9 muOnline

It is important to visit muOnline regularly for up-to-date information about the course. It hosts all the course materials including assignments, handouts, lecture notes, and reading materials.

10 Policy for Students with Disabilities

Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities. University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304-696-2271, to provide documentation of their disability. Following this, the DSS Coordinator will send a letter to each of the student's instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 117, phone 304-696-2271.

11 Bibliography

[1] Joseph Adler. *R in a Nutshell: A Desktop Quick Reference.* Sabestopol, CA: O'Reilly Media, 2010.

[2] Soyeon Ahn. "Introduction to bioinformatics: sequencing technology". In: *Asia Pac allergy* 1.2 (2011), pp. 93 -97.

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[4] Sebastian Bassi. *Python for Bioinformatics.* Chapman & Hall/CRC, 2009.

[5] Andreas D. Baxevanis and B. F. Francis Ouellette. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins.* Wiley-Interscience, 2004.

[6] Edward B. Burger and Michael Starbird. *The 5 Elements of Effective Thinking.* Princeton University Press, 2012.

[7] Vernon L. Ceder. *The Quick Python Book.* Manning Publications Co., 2010.

[8] Winston Chang. *R Graphics Cookbook: Practical Recipes for Visualizing Data.* O'Reilly Media, 2012.

[9] Wesley J. Chun. *Core Python Applications Programming.* 3rd. Upper Saddle River, NJ, USA: Prentice Hall Press, 2012.

[10] Jean-Michel Claverie and Cedric Notredame. *Bioinformatics For Dummies.* John Wiley, 2006.

[11] Jacques Cohen. "Bioinformatics - An Introduction for Computer Scientists". In: *ACM Computing Surveys* 36.2 (2004), pp. 122–158.

[12] Jacques Cohen. "The crucial role of CS in systems and synthetic biology". In: *Communications of the ACM* 51.5 (May 2008), p. 15.

[13] Iraj Daizadeh. "An Example of Information Management in Biology: Qualitative Data Economizing Theory Applied to the Human Genome Project Databases". In: *Journal of the American Society for Information Science and Technology* 57.2 (2006), pp. 244–250.

[14] Dipak K. Dey, Samiran Ghosh, and Bani K. Mallick. *Bayesian Modeling in Bioinformatics.* Chapman & Hall/CRC, 2010.

[15] Toby Donaldson. *Python: Visual QuickStart Guide.* 2nd. Berkeley, CA, USA: Peachpit Press, 2008.

[16] Allen B. Downey. *Think Python: How to Think Like a Computer Scientist.* O'Reilly Media, Inc., 2012.

[17] Sorin Drghici. *Statistics and Data Analysis for Microarrays Using R and Bioconductor.* Second. Chapman and Hall/CRC, 2011.

[18] Sumeet Dua and Pradeep Chowriappa. *Data Mining for Bioinformatics.* Chapman & Hall/CRC, 2012.

[19] Richard Durbin et al. *Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids.* Cambridge University Press, 1998.

[20] Susanna S. Epp. *Discrete Mathematics: Introduction to Mathematical Reasoning.* Brief Edition. Brooks/Cole Publishing Company, 2011.

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[22] Ben Fry. *Visualizing Data: Visualizing Data Exploring and Explaining Data with the Processing Environment.* O'Reilly Media, 2007.

[23] Frank R. Giordano, William P. Fox, and Steven B. Horton. *A First Course in Mathematical Modeling.* Fifth Edition. Brooks/Cole Publishing Company, 2014.

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[25] Dan Gusfield. *Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology.* Cambridge University Press, 1997.

[26] Steven Haddock and Casey Dunn. *Practical Computing for Biologists.* Sinauer Associates, Inc., 2010.

[27] Brian Heinold. *An Introduction to Programming Using Python.* Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License, `http://faculty.msmary.edu/heinold/Introduction_to_Programming_Using_Python_Heinold.pdf`, 2012.

[28] Doug Hellmann. *The Python Standard Library by Example.* 1st. Addison-Wesley Professional, 2011.

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[30] Hongkai Ji and Wing Hung Wong. "Computational biology: toward deciphering gene regulatory information in mammalian genomes". In: *Biometrics* 62.3 (Sept. 2006), pp. 645–663.

[31] Neil C. Jones and Pavel A. Pevzner. *An Introduction to Bioinformatics Algorithms.* MIT Press, 2004.

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[40] W. John MacMullen and Sheila O. Denn. "Information problems in molecular biology and bioinformatics". In: *Journal of the American Society for Information Science and Technology* 56.5 (Mar. 2005), pp. 447–456.

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[45] Mitchell L. Model. *Bioinformatics Programming Using Python: Practical Programming for Biological Data.* O'Reilly Media, 2009.

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[51] Tore Samuelsson. *Genomics and Bioinformatics: An Introduction to Programming Tools for Life Scientists.* Cambridge University Press, 2012.

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[55] Mark Summerfield. *Programming in Python 3: A Complete Introduction to the Python Language.* 1st. Addison-Wesley Professional, 2008.

[56] David Wayne Ussery, Trudy M. Wassenaar, and Stefano Borini. *Computing for Comparative Microbial Genomics: Bioinformatics for Microbiologists.* Springer, 2010.

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[58] Röbbe Wünschiers. *Computational Biology -: Unix/Linux, Data Processing and Programming.* Springer, 2004.

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[60] John Zelle. *Python Programming: An Introduction to Computer Science.* Second. Franklin, Beedle & Associates, 2010.

[61] Marketa Zvelebil and Jeremy Baum. *Understanding Bioinformatics.* Garland Science, 2007.

Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Computer Science | Alpha Designator/Number: CS 510 | (•) Graded ( ) CR/NC

Contact Person: Venkat N Gudivada | Phone: 304 - 696 - 5452

NEW COURSE DATA:

New Course Title: Database Systems

Alpha Designator/Number: C S 5 1 0

Title Abbreviation: D a t a b a s e S y s t e m s

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

Study of relational data model and abstract query languages, SQL, logical and physical database design, transactions, database recovery, query optimization, XML databases, issues in managing Big Data, and NewSQL systems.

Co-requisite(s): None

First Term to be Offered: Fall 2014

Prerequisite(s): ~~CS 210 or CS 505~~ ~~AN~~ (None)

Credit Hours: 3.0

Course(s) being deleted in place of this addition (*must submit course deletion form*): None

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date 12-March-2013
Registrar 110101	Date 3/13/13
College Curriculum Chair	Date 4/10/13
Graduate Council Chair	Date 5/23/13

Request for Graduate Course Addition - Page 2

College: CITTE | Department/Division: Computer Science | Alpha Designator/Number: CS 510

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

John Biros, Jonathan Thompson, Venkat Gudivada

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Existing Marshall University BigGreen supercomputer is adequate for the proposed course. No additional resources are required.

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Please see attached syllabus document.

7. COURSE OUTLINE (May be submitted as a separate document)

Please see attached syllabus document.

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Please see attached syllabus document.

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture, lab, design and programming problems.

Request for Graduate Course Addition - Page 4

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Team project, term paper, midterm exam, final exam.

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

Not Applicable

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

See attached syllabus document.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Weisberg Division of Computer Science

Course Number and Title: CS 510: Database Systems

Catalog Description: Study of relational data model and abstract query languages, SQL, logical and physical database design, transactions, database recovery, query optimization, XML databases, issues in managing Big Data, and NewSQL systems.

Prerequisites: ~~CS 210 or CS 505~~ AN

First Term Offered: Fall 2014

Credit Hours: 3.0

Marshall University Syllabus

Course Title/Number	Database Systems/ CS 510
Semester/Year	Fall/2014
Days/Time	TR /3.30 - 4.45 PM
Location	GH 211
Instructor	Venkat N Gudivada
Office	GH 207A
Phone	304 - 696 - 5452
Email	gudivada@marshall.edu
Office/Hours	MWF 10.00 - 12.00 Noon
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment.

1 Course Description: From Catalog

Study of relational data model and abstract query languages, SQL, logical and physical database design, transactions, database recovery, query optimization, XML databases, issues in managing Big Data, and NewSQL systems. PR: ~~CS 210 or CS 505~~

2 Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Course Student Learning Outcomes	How **students will practice each outcome** in this Course	How **student achievement of each outcome will be assessed** in this Course
Students will **enhance their writing skills and strategies** by writing a term paper which critically analyzes and evaluates a specific trend or technology in the area of databases and information retrieval	Informal in-class writing, and guided discussions	Research-oriented term paper
Students will **be able to demonstrate knowledge and skill** in applying relational database theory to developing practical database applications in a team environment	In class exercises, and guided discussions	Team project, formal writing, and exams
Students will **be able to write database queries and also programmatically manipulate data** using relational algebra and calculus, SQL, and a general-purpose programming language	In class exercises, and guided discussions	Programming assignments, and exams
Students will **be able to improve execution time of SQL queries** by examining query execution plans and making suitable changes to physical database design	In-class exercises, and guided discussions	Programming assignments, and exams
Students will **be able to write database views, triggers, and stored procedures** to improve: ease of user and application access to data; enhance data integrity; and secure databases	In-class exercises, and guided discussions	Programming assignments, and exams
Students will **have the knowledge and skill to manage XML data using XML databases**	In-class exercises, and guided discussions	Programming assignments, and exams
Students will **have the knowledge of current trends and emerging technologies** for data and information management	Reading current literature, and in-class guided discussions	Term paper

3 Required Texts, Additional Reading, and Other Materials

Required Text

[1] Hector Garcia-Molina, Jeffrey D. Ullman, and Jennifer Widom. *Database Systems: The Complete Book.* Second. Prentice Hall, 2008.

Additional Reading

[1] Ramez Elmasri and Shamkant Navathe. *Fundamentals of Database Systems.* Sixth. Addison Wesley, 2010.

[2] Raghu Ramakrishnan and Johannes Gehrke. *Database Management Systems.* McGraw-Hill, 2002.

Web Resources

- Download PostgreSQL from EnterpriseDB here.
- pgAdmin — an open source tool for PostgreSQL administration and database development. Download it here.
- SQL Power Architect — an open source tool for Data Modeling and Profiling. Download it here.
- PostgreSQL Wiki here.

4 Course Schedule

- Week 1
  - Relational data model and constraints
  - Relational abstract query language: Relational Algebra
- Week 2 - 3
  - Relational abstract query languages: Tuple and Domain Relational Calculus
  - SQL and database programming
- Week 4
  - Conceptual data modeling
- Week 5 - 6
  - Logical database design
- Week 7
  - Physical database design

- Week 8 - 9
  - Query optimization
  - Midterm exam
- Week 10
  - Transaction control
- Week 11
  - Database views, triggers, and stored procedures
  - Authorization and access control
- Week 12
  - XML databases
- Week 13 - 14
  - Current database trends and emerging technologies
- Week 15
  - Final exam

5 Term paper

You will write a term paper which critically analyzes and evaluates a specific trend or technology in the area of databases and information retrieval. These papers are about 10 pages in length and require at least two revisions. This activity spans the entire term. Topics may include but not limited to:

① Issues in managing massive datasets (aka Big Data)

② NewSQL Systems (e.g., H-Store parallel database system, Google Spanner, Clustrix, NuoDB, VoltDB, SQLFire, ScaleDB, TokuDB, MemSQL, Akiban, dbShards, Scalearc, ScaleBase)

③ NoSQL Systems (e.g., AllegoGraph, Neo4J, FlockDB, Apache Hadoop HBase, Apache CouchDB, Apache Cassandra, MongoDB, Riak, and Redis)

A template for developing the term paper will be provided in a separate handout.

6 Team Project

This course requires one formal, substantial design assignment. You will complete this assignment by working with students in the class in a small team environment (typically 2 students). The assignment involves developing a database application from its inception to delivery and deployment. This process requires developing several documents including requirements elicitation and analysis, conceptual database design, selecting a database management system, logical database design, physical database design, creating and populating the database, transaction and application implementation. These documents are revised based on self-evaluation, peer and instructor feedback, and then resubmitted. Details will be provided in separate handouts.

7 Course Requirements/Due Dates

Activity/Deliverable	Due Date
Midterm exam	October, 14
Team project	November, 20
Term paper	December, 2
Final exam	December, 9

8 Grading Policy

Activity	Weight
Design assignments	15%
Programming assignments	15%
Midterm exam	20 %
Term paper	20%
Final exam	30%

Course grade is awarded based on the following scheme:

Score	Letter Grade
>= 90	A
>= 80 & < 90	B
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< 60	F

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Attendance will be taken at the start of class. Only university excused absences will be accepted.

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It is important to visit muOnline regularly for up-to-date information about the course. It hosts all the course materials including assignments, handouts, lecture notes, and reading materials.

12 Policy for Students with Disabilities

Marshall University is committed to equal opportunity in education for all students, including those with physical, learning and psychological disabilities. University policy states that it is the responsibility of students with disabilities to contact the Office of Disabled Student Services (DSS) in Prichard Hall 117, phone 304-696-2271, to provide documentation of their disability. Following this, the DSS Coordinator will send a letter to each of the student's instructors outlining the academic accommodation he/she will need to ensure equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 117, phone 304-696-2271.

13 Bibliography

[1] Wesley J. Chun. *Core Python Applications Programming.* 3rd. Upper Saddle River, NJ, USA: Prentice Hall Press, 2012.

[2] Keith Devlin. *Introduction to Mathematical Thinking.* Keith Devlin, 2012.

[3] Sumeet Dua and Pradeep Chowriappa. *Data Mining for Bioinformatics.* Chapman & Hall/CRC, 2012.

[4] Brian Heinold. *An Introduction to Programming Using Python.* Creative Commons Attribution-Noncommercial-Share Alike 3.0 Unported License, http://faculty.msmary.edu/heinold/Introduction_to_Programming_Using_Python_Heinold.pdf, 2012.

[5] Alex Holmes. *Hadoop in Practice.* Manning Publications Co., 2012.

[6] Grant S. Ingersoll, Thomas S. Morton, and Andrew L. Farris. *Taming Text: How to Find, Organize, and Manipulate It.* Manning Publications Co., 2012.

[7] Mark J. Johnson. *A Concise Introduction to Programming in Python.* Chapman & Hall/CRC, 2012.

[8] Donald Metzler. *A Feature-Centric View of Information Retrieval.* Springer, 2012.

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[10] Ricardo Baeza-Yates and Berthier Ribeiro-Neto. *Modern Information Retrieval: The Concepts and Technology Behind Search.* Second. 9780321416919. Addison-Wesley Professional, 2011.

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[14] Matthew A. Russell. *Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites.* O'Reilly Media, 2011.

[15] Stefan Buettcher, Charles L. A. Clarke, and Gordon V. Cormack. *Information Retrieval: Implementing and Evaluating Search Engines.* MIT Press, 2010.

[16] Vernon L. Ceder. *The Quick Python Book.* Manning Publications Co., 2010.

[17] Ramez Elmasri and Shamkant Navathe. *Fundamentals of Database Systems.* Sixth. Addison Wesley, 2010.

[18] Philipp K. Janert. *Data Analysis with Open Source Tools.* Sabestopol, CA: O'Reilly Media, 2010.

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[25] C.J. Date. *SQL and Relational Theory: How to Write Accurate SQL Code.* O'Reilly Media, 2009.

[26] Jason Kinser. *Python For Bioinformatics.* Jones and Bartlett, 2009.

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[28] Toby Segaran and Jeff Hammerbacher. *Beautiful Data.* O'Reilly Media, 2009.

[29] Hadley Wickham. *ggplot2: Elegant Graphics for Data Analysis.* Springer, 2009.

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[33] J.D. Ullman and J. Widom. *A First Course in Database Systems.* Third. Pearson, 2008.

[34] Lynn Beighley. *Head First SQL.* O'Reilly Media, 2007.

[35] Andrew Cumming and Gordon Russell. *SQL Hacks.* O'Reilly Media, 2007.

[36] Ben Fry. *Visualizing Data: Visualizing Data Exploring and Explaining Data with the Processing Environment.* O'Reilly Media, 2007.

[37] Toby Segaran. *Programming Collective Intelligence: Building Smart Web 2.0 Applications.* O'Reilly Media, 2007.

[38] Joe Celko. *Joe Celko's SQL Puzzles and Answers.* Morgan Kaufmann, 2006.

[39] Stephane Faroult and Peter Robson. *The Art of SQL.* O'Reilly Media, 2006.

[40] David A. Grossman and Ophir Frieder. *Information Retrieval: Algorithms and Heuristics.* Springer, 2004.

[41] Neil C. Jones and Pavel A. Pevzner. *An Introduction to Bioinformatics Algorithms.* MIT Press, 2004.

[42] Raghu Ramakrishnan and Johannes Gehrke. *Database Management Systems.* McGraw-Hill, 2002.

Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Computer Science | Alpha Designator/Number: CS 540 | (•) Graded ( ) CR/NC

Contact Person: Venkat N Gudivada | Phone: 304 - 696 - 5452

NEW COURSE DATA:

New Course Title: Digital Image Processing

Alpha Designator/Number: C S 5 4 0

Title Abbreviation: D i g i t a l I m a g e P r o c e s s i n g

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

Study of mathematical techniques and algorithms for image sampling, quantization, intensity transformations, spatial filtering, Fourier transforms, frequency domain filtering, restoration and reconstruction, color imaging, wavelets, morphological image processing, and segmentation.

Co-requisite(s): None | First Term to be Offered: Fall 2014

Prerequisite(s): ~~(MTH 230 and MTH 345), or C~~ None (AN) | Credit Hours: 3.0

Course(s) being deleted in place of this addition (*must submit course deletion form*): None

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date 12-March-2013
Registrar 110101	Date 3/12/13
College Curriculum Chair	Date 4/10/13
Graduate Council Chair	Date 5/23/13

Request for Graduate Course Addition - Page 2

College: CITTE | Department/Division: Computer Science | Alpha Designator/Number: CS 540

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

Jonathan Thompson, Venkat Gudivada

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Existing Marshall University BigGreen supercomputer is adequate for the proposed course. No additional resources are required.

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Please see attached syllabus document.

7. COURSE OUTLINE (May be submitted as a separate document)

Please see attached syllabus document.

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Please see attached syllabus document.

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture, lab, design and programming problems.

Request for Graduate Course Addition - Page 4

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Design and programming assignments, midterm exam, final exam.

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

Not Applicable

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

See attached syllabus document.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Weisberg Division of Computer Science

Course Number and Title: CS 540: Digital Image Processing

Catalog Description: Study of mathematical techniques and algorithms for image sampling, quantization, intensity transformations, spatial filtering, Fourier transforms, frequency domain filtering, restoration and reconstruction, color imaging, wavelets, morphological image processing, and segmentation.

Prerequisites: ~~(MTH 230 and MTH 345), or CS 505~~ Delete AN

First Term Offered: Fall 2014

Credit Hours: 3.0

Marshall University Syllabus

Course Title/Number	Digital Image Processing/ CS 540
Semester/Year	Fall/2014
Days/Time	TR /3.30 - 4.45 PM
Location	GH 211
Instructor	Venkat N Gudivada
Office	GH 207A
Phone	304 - 696 - 5452
Email	gudivada@marshall.edu
Office/Hours	MWF 10.00 - 12.00 Noon
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment.

1 Course Description: From Catalog

Study of mathematical techniques and algorithms for image sampling, quantization, intensity transformations, spatial filtering, Fourier transforms, frequency domain filtering, restoration and reconstruction, color imaging, wavelets, morphological image processing, and segmentation. PR: ~~(MTH 230 and MTH 345), or CS 505~~

2 Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Course Student Learning Outcomes	How **students will practice each outcome** in this Course	How **student achievement of each outcome will be assessed** in this Course
Students will **be able to explain various fundamental steps in digital image processing** and components of a typical image processing system	In-class exercises, and guided discussions	Homework assignments, and exams
Students will **be able to apply image sampling and quantization principles** in acquiring digital images using various sensors	Laboratory exercises, and guided discussions	Homework assignments, and exams
Students will **be able to enhance images by applying intensity transformations and spatial filtering** algorithms to corrupted/degraded digital images	In-class exercises	Programming assignments, and exams
Students will **be able to enhance images by applying frequency domain filtering** algorithms to corrupted/degraded digital images	In-class exercises	Programming assignments, and exams
Students will **be able to restore and reconstruct images by modeling noise and degradation, and using a series of projections**	In-class exercises	Programming assignments, and exams
Students will **have the knowledge and skill in applying a range of methods for processing color images**	In-class exercises	Programming assignments, and exams
Students will **have the knowledge and skill in applying wavelet transforms** for tasks ranging from image coding, noise removal, to edge detection	In-class exercises	Programming assignments, and exams
Students will **have the knowledge and skill in applying mathematical morphology operators and algorithms** for tasks ranging from boundary extraction, hole filling, connected components extraction, thinning, thickening, to skeletons	In-class exercises	Programming assignments, and exams

Students will **have the knowledge and skill in applying segmentation algorithms** for tasks such as detection of points, lines, and edges	In-class exercises	Programming assignments, and exams

3 Required Texts, Additional Reading, and Other Materials

Required Text

[1] Rafael C. Gonzalez and Richard E. Woods. *Digital Image Processing.* Third. Prentice Hall, 2008.

Additional Reading

[1] Wilhelm Burger and Mark J. Burge. *Digital Image Processing: An Algorithmic Introduction Using Java.* Springer, 2008.

[2] Kurt Demaagd et al. *Practical Computer Vision with SimpleCV.* O'Reilly, 2012.

[3] Karl Fraser, Zidong Wang, and Xiaohui Liu. *Microarray Image Analysis: An Algorithmic Approach.* Chapman & Hall/CRC, 2010.

[4] Jan Erik Solem. *Programming Computer Vision with Python: Tools and algorithms for analyzing images.* O'Reilly, 2012.

[5] Steven L. Tanimoto. *An Interdisciplinary Introduction to Image Processing: Pixels, Numbers, and Programs.* MIT Press, 2012.

[6] Translational College of LEX. *Who is Fourier? A Mathematical Adventure.* Boston, MA: Language Research Foundation, 1995.

Web Resources

- Computer Vision: Algorithms and Applications - **free, online book**
- Pattern Recognition and Machine Learning
- Little Book of R for Biomedical Statistics

4 Course Schedule

- Week 1 - 2
  - Image sensing and acquisition
  - Image sampling and quantization
- Week 3 - 4
  - Intensity transformations

- ✧ Spatial filtering

- Week 5 - 6
  - ✧ Fourier transform and frequency domain filtering
- Week 7 - 8
  - ✧ Image restoration and reconstruction
  - ✧ Midterm exam
- Week 9
  - ✧ Color image processing
- Week 10
  - ✧ Wavelet transforms
- Week 11 - 12
  - ✧ Morphological image processing
- Week 13 - 14
  - ✧ Image segmentation
- Week 15
  - ✧ Final exam

5 Grading Policy

Activity	Weight
Design assignments	20%
Programming assignments	30%
Midterm exam	20 %
Final exam	30%

Course grade is awarded based on the following scheme:

Score	Letter Grade
>= 90	A
>= 80 & < 90	B
>= 70 & < 80	C
>= 60 & < 70	D
< 60	F

6 Attendance Policy

Attendance will be taken at the start of class. Only university excused absences will be accepted.

7 Classroom Etiquette

- Students are expected to show up for class on time and remain in the class for the entire duration of the class.
- Students are not allowed to use personal laptops during the lecture part of the class.
- All types of phones and personal digital assistants must be turned off or put in silent mode during lectures.
- While taking tests, all types of electronic gadgets including cell phones, iPhones, iPod touch, blackberries, laptops must be turned off. No internet browsing is allowed during test taking.

8 muOnline

It is important to visit muOnline regularly for up-to-date information about the course. It hosts all the course materials including assignments, handouts, lecture notes, and reading materials.

9 Policy for Students with Disabilities

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equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 117, phone 304-696-2271.

10 Bibliography

[1] Daniel Lélis Baggio et al. *Mastering OpenCV with Practical Computer Vision Projects.* Packt Publishing, 2012.

[2] Gary Bradski and Adrian Kaehler. *Learning OpenCV: Computer Vision in C++ with the OpenCV Library.* O'Reilly, 2012.

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[8] Benedict Gaster et al. *Heteorgeneous Computing with OpenCL.* Morgan Kaufmann, 2011.

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[10] T. Hey, S. Tansley, and K. Toll, eds. *The Fourth Paradigm: Data-Intensive Scientific Discovery.* 1.1. Microsoft Press, 2009.

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[14] Ben Klemens. *21st Century C: Tips from the New School.* O'Reilly, 2012.

[15] Alasdair McAndrew. *Introduction to Digital Image Processing with Matlab.* Thompson Course Technology, 2004.

[16] Maria Petrou and Costas Petrou. *Image Processing: The Fundamentals.* John Wiley, 2010.

[17] Jason Sanders and Edward Kandrot. *CUDA by Example: An Introduction to General-Purpose GPU Programming.* Addison-Wesley, 2011.

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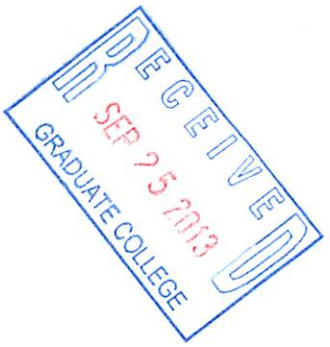
[22] Scott E Umbaugh. *Digital Image Processing and Analysis: Human and Computer Vision Applications with CVIPtools.* Second Edition. CRC Press, 2010.

[23] Hadley Wickham. *ggplot2: Elegant Graphics for Data Analysis.* Springer, 2009.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SEP 25 2013
GRADUATE COLLEGE

Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Computer Science | Alpha Designator/Number: CS 630 | (•) Graded ( ) CR/NC

Contact Person: Venkat N Gudivada | Phone: 304 - 696 - 5452

NEW COURSE DATA:

New Course Title: Machine Learning

Alpha Designator/Number: C S 6 3 0

Title Abbreviation: M a c h i n e L e a r n i n g

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)
Study of machine learning and statistical pattern recognition algorithms and their application to data mining, bioinformatics, speech recognition, natural language processing, robotic control, autonomous navigation, text and web data processing.

Co-requisite(s): None | First Term to be Offered: Fall 2014

Prerequisite(s): ~~(MTH 326 or MTH 329 or MTH~~ delete (None) | Credit Hours: 3.0

Course(s) being deleted in place of this addition (*must submit course deletion form*): None

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date 12-March-2013
Registrar 110101	Date 3/12/13
College Curriculum Chair	Date 4/10/13
Graduate Council Chair	Date 5/23/13

Request for Graduate Course Addition - Page 2

College: CITTE | Department/Division: Computer Science | Alpha Designator/Number: CS 630

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

John Biros, Venkat Gudivada

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Existing Marshall University BigGreen supercomputer is adequate for the proposed course. No additional resources are required.

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Please see attached syllabus document.

7. COURSE OUTLINE (May be submitted as a separate document)

Please see attached syllabus document.

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Please see attached syllabus document.

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture, lab, design and programming problems.

Request for Graduate Course Addition - Page 4

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Design and programming assignments, midterm exam, final exam.

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

Not Applicable

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

See attached syllabus document.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Weisberg Division of Computer Science

Course Number and Title: CS 630: Machine Learning

Catalog Description: Study of machine learning and statistical pattern recognition algorithms and their application to data mining, bioinformatics, speech recognition, natural language processing, robotic control, autonomous navigation, text and web data processing.

Prerequisites: ~~(MTH 326 or MTH 329 or MTH 345) and (CS 300 or CS 505)~~ delete AN

First Term Offered: Fall 2014

Credit Hours: 3.0

Marshall University Syllabus

Course Title/Number	Machine Learning/ CS 630
Semester/Year	Fall/2014
Days/Time	TR /3.30 - 4.45 PM
Location	GH 211
Instructor	Venkat N Gudivada
Office	GH 207A
Phone	304 - 696 - 5452
Email	gudivada@marshall.edu
Office/Hours	MWF 10.00 - 12.00 Noon
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment.

1 Course Description: From Catalog

Study of machine learning and statistical pattern recognition algorithms and their application to data mining, bioinformatics, speech recognition, natural language processing, robotic control, autonomous navigation, text and web data processing. ~~PR: (MTH 326 or MTH 329 or MTH 345) and (CS 300 or CS 505)~~

2 Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Course Student Learning Outcomes	How **students will practice each outcome** in this Course	How **student achievement of each outcome will be assessed** in this Course
Students **will have a broad understanding of various machine learning and statistical pattern recognition algorithms** and their application to diverse practical problems	In-class exercises, and guided discussions	Homework assignments, and exams
Students **will be able to understand and apply supervised learning algorithms** (parametric/non-parametric algorithms, support vector machines, kernels, neural networks) to solve practical problems	In-class exercises, and guided discussions	Programming assignments, homework assignments, and exams
Students **will be able to understand and apply unsupervised learning algorithms** (clustering, dimensionality reduction, recommender systems, deep learning) to solve practical problems	In-class exercises, and guided discussions	Programming assignments, homework assignments, and exams
Students **will be able to apply best practices in machine learning** (bias/variance theory) to solve diverse problems in domains ranging from data mining, bioinformatics, speech recognition, natural language processing, robotic control, autonomous navigation, text and web data processing	In-class exercises, and guided discussions	Programming assignments, homework assignments, and exams

3 Required Texts, Additional Reading, and Other Materials

Required Text

[1] Yaser S. Abu-Mostafa, Malik Magdon-Ismail, and Hsuan-Tien Lin. *Learning From Data.* AML-Book, 2012.

Additional Reading

[1] Drew Conway and John Myles White. *Machine Learning for Hackers: Case Studies and Algorithms to Get You Started.* O'Reilly Media, 2012.

[2] Sumeet Dua and Pradeep Chowriappa. *Data Mining for Bioinformatics.* Chapman & Hall/CRC, 2012.

[3] Ravi Kant, Srinivasan H. Sengamedu, and Krishnan S. Kumar. "Comment spam detection by sequence mining". In: *Proceedings of the fifth ACM international conference on Web search and data mining.* WSDM '12. New York, NY, USA: ACM, 2012, pp. 183–192.

[4] Yehuda Koren, Robert Bell, and Chris Volinsky. "Matrix Factorization Techniques for Recommender Systems". In: *Computer* 42 (2009), pp. 30–37.

[5] Raymond Y. K. Lau et al. "Text mining and probabilistic language modeling for online review spam detection". In: *ACM Trans. Manage. Inf. Syst.* 2.4 (Jan. 2012), 25:1–25:30.

[6] Wu-Jun Li and Dit-Yan Yeung. "MILD: Multiple-Instance Learning via Disambiguation". In: *IEEE Transactions on Knowledge & Data Engineering* 22.1 (2010), pp. 76 –89.

[7] Jimmy Lin and Alek Kolcz. "Large-Scale Machine Learning at Twitter". In: *Proceedings of SIGMOD '12.* SIGMOD. ACM, 2012, pp. 793–804.

[8] Sushmita Mitra et al. *Introduction to Machine Learning and Bioinformatics.* Chapman & Hall/CRC, 2008.

[9] Georgios Paltoglou and Mike Thelwall. "Twitter, MySpace, Digg: Unsupervised Sentiment Analysis in Social Media". In: *ACM Trans. Intell. Syst. Technol.* 3.4 (Sept. 2012), 66:1–66:19.

[10] Simon Rogers and Mark Girolami. *A First Course in Machine Learning.* Chapman & Hall/CRC, 2011.

[11] Matthew A. Russell. *Mining the Social Web: Analyzing Data from Facebook, Twitter, LinkedIn, and Other Social Media Sites.* O'Reilly Media, 2011.

Web Resources

- CalTech Machine Learning Course - YouTube Playlist
- Computer Vision: Algorithms and Applications - **free, online book**
- Pattern Recognition and Machine Learning
- Little Book of R for Biomedical Statistics

4 Course Schedule

- Week 1
  - Machine Learning problem
  - Supervised and unsupervised learning
- Week 2 - 3
  - Linear regression with single and multiple variables

- Week 4
  - Logistic regression
- Week 5
  - Regularization
- Week 6 - 7
  - Neural Networks
- Week 8 - 9
  - Support Vector Machines
  - Midterm
- Week 10 - 11
  - Clustering
  - Dimensionality reduction
- Week 12
  - Anomaly detection
- Week 13
  - Recommender systems
- Week 14
  - Large scale machine learning
- Week 15
  - Final exam

5 Grading Policy

Activity	Weight
Design assignments	20%
Programming assignments	30%
Midterm exam	20 %
Final exam	30%

Course grade is awarded based on the following scheme:

Score	Letter Grade
>= 90	A
>= 80 & < 90	B
>= 70 & < 80	C
>= 60 & < 70	D
< 60	F

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Attendance will be taken at the start of class. Only university excused absences will be accepted.

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equality in classroom experiences, outside assignment, testing and grading. The instructor and student will meet to discuss how the accommodation(s) requested will be provided. For more information, please visit http://www.marshall.edu/disabled or contact Disabled Student Services Office at Prichard Hall 117, phone 304-696-2271.

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Chair: Tracy Christofero | **GC#6: Course Addition**

Request for Graduate Course Addition

1. Prepare one paper copy with all signatures and supporting material and forward to the Graduate Council Chair.
2. E-mail one identical PDF copy to the Graduate Council Chair. If attachments included, please merge into a single file.
3. ***The Graduate Council cannot process this application until it has received both the PDF copy and the signed hard copy.***

College: CITE | Dept/Division: Computer Science | Alpha Designator/Number: CS 645 | (•) Graded ( ) CR/NC

Contact Person: Venkat N Gudivada | Phone: 304 - 696 - 5452

NEW COURSE DATA:

New Course Title: Advanced Topics in Bioinformatics

Alpha Designator/Number: C S 6 4 5

Title Abbreviation: A d v T o p i n B i o i n f o r m a t i c s

(Limit of 25 characters and spaces)

Course Catalog Description: (Limit of 30 words)

Study of advanced algorithms, data structures, and architectures required for solving complex problems in Bioinformatics. Focus is on analysis of patterns in sequences and 3D-structures. Team taught seminar course.

Co-requisite(s): None

First Term to be Offered: Spring 2015

Prerequisite(s): CS 505

Credit Hours: 3.0

Course(s) being deleted in place of this addition (*must submit course deletion form*): None

Signatures: if disapproved at any level, do not sign. Return to previous signer with recommendation attached.

Dept. Chair/Division Head	Date 12-March-2013
Registrar 11/01	Date 3/12/13
College Curriculum Chair	Date 4/10/13
Graduate Council Chair	Date 5/23/13

Request for Graduate Course Addition - Page 2

College: CITTE | Department/Division: Computer Science | Alpha Designator/Number: CS 645

Provide complete information regarding the new course addition for each topic listed below. Before routing this form, a complete syllabus also must be attached addressing the items listed on the first page of this form.

1. FACULTY: Identify by name the faculty in your department/division who may teach this course.

Philippe Georgel, Wendy Trzyna, Jim Denvir, Venkat Gudivada

2. DUPLICATION: If a question of possible duplication occurs, attach a copy of the correspondence sent to the appropriate department(s) describing the proposal. Enter "***Not Applicable***" if not applicable.

Not Applicable

3. REQUIRED COURSE: If this course will be required by another deparment(s), identify it/them by name. Enter "***Not Applicable***" if not applicable.

Not Applicable

4. AGREEMENTS: If there are any agreements required to provide clinical experiences, attach the details and the signed agreement. Enter "***Not Applicable***" if not applicable.

Not Applicable

5. ADDITIONAL RESOURCE REQUIREMENTS: If your department requires additional faculty, equipment, or specialized materials to teach this course, attach an estimate of the time and money required to secure these items. (Note: Approval of this form does not imply approval for additional resources.) Enter "***Not Applicable***" if not applicable.

Existing Marshall University BigGreen supercomputer is adequate for the proposed course. No additional resources are required.

6. COURSE OBJECTIVES: (May be submitted as a separate document)

Please see attached syllabus document.

7. COURSE OUTLINE (May be submitted as a separate document)

Please see attached syllabus document.

8. SAMPLE TEXT(S) WITH AUTHOR(S) AND PUBLICATION DATES (May be submitted as a separate document)

Please see attached syllabus document.

9. EXAMPLE OF INSTRUCTIONAL METHODS (Lecture, lab, internship)

Lecture and computer lab.

Request for Graduate Course Addition - Page 4

10. EXAMPLE EVALUATION METHODS (CHAPTER, MIDTERM, FINAL, PROJECTS, ETC.)

Student class presentations and research paper.

11. ADDITIONAL GRADUATE REQUIREMENTS IF LISTED AS AN UNDERGRADUATE/GRADUATE COURSE

Not Applicable

12. PROVIDE COMPLETE BIBLIOGRAPHY (May be submitted as a separate document)

See attached syllabus document.

Request for Graduate Course Addition - Page 5

Please insert in the text box below your course summary information for the Graduate Council agenda. Please enter the information exactly in this way (including headings):

Department:
Course Number and Title:
Catalog Description:
Prerequisites:
First Term Offered:
Credit Hours:

Department: Weisberg Division of Computer Science

Course Number and Title: CS 645: Advanced Topics in Bioinformatics

Catalog Description: Study of advanced algorithms, data structures, and architectures required for solving complex problems in Bioinformatics. Focus is on analysis of patterns in sequences and 3D-structures. Team taught seminar course.

Prerequisites: CS 505

First Term Offered: Spring 2015

Credit Hours: 3.0

Marshall University Syllabus

Course Title/Number	Advanced Topics in Bioinformatics/ CS 645
Semester/Year	Fall/2014
Days/Time	TR /3.30 - 4.45 PM
Location	GH 211
Instructor(s)	Venkat Gudivada and Philippe Georgel
Office	GH 207A
Phone	304 - 696 - 5452
Email	gudivada@marshall.edu
Office/Hours	MWF 10.00 - 12.00 Noon
University Policies	By enrolling in this course, you agree to the University Policies listed below. Please read the full text of each policy be going to www.marshall.edu/academic-affairs and clicking on "Marshall University Policies." Or, you can access the policies directly by going to http://www.marshall.edu/academic-affairs/?page_id=802 Academic Dishonesty/ Excused Absence Policy for Undergraduates/ Computing Services Acceptable Use/ Inclement Weather/ Dead Week/ Students with Disabilities/ Academic Forgiveness/ Academic Probation and Suspension/ Academic Rights and Responsibilities of Students/ Affirmative Action/ Sexual Harassment.

1 Course Description: From Catalog

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2 Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Course Student Learning Outcomes	How **students will practice each outcome** in this Course	How **student achievement of each outcome will be assessed** in this Course
Students **will enhance their ability to read, analyze, and understand Bioinformatics research literature**	In-class research paper presentations, and guided discussions	Reading research papers, term research paper
Students **will enhance their writing skills and strategies** by writing a formal term paper on a specific Bioinformatics research problem	In-class research paper presentations	Term research paper
Students **will enhance their technical oral communication skills**	In-class research paper presentations	Quality of in-class student presentations
Students **will be able determine appropriate algorithms, data structures, and architectures** to solve a given Bioinformatics problem	In-class guided discussion on pre-assigned research papers	In-class student presentations

3 Required Texts, Additional Reading, and Other Materials

- The course will be team taught in a seminar style from interdisciplinary faculty from CITE, COS, and SOM. Course materials are based on current research papers on Bioinformatics problems. Papers will be collected, studied, and presented to the class by both instructors and students.

4 Course Schedule

- Weeks 1 - 4
  - Orientation to the course in the form of instructor presentations on current research problems in Bioinformatics.
- Week 5 - 14
  - Two rounds of presentations by students on their chosen research problems in Bioinformatics
- Week 15

- ✧ Students' final presentations on their research topics

5 Grading Policy

Activity	Weight
Student class participation	10%
Student class presentations	30%
Research paper	60 %

Course grade is awarded based on the following scheme:

Score	Letter Grade
>= 90	A
>= 80 & < 90	B
>= 70 & < 80	C
>= 60 & < 70	D
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