De Anza College
Course Outline of Record Report
10/02/2025

CISD078. : Introduction to Deep Learning

General Information

Faculty Initiator:	• Sukhjit Singh • Pape, Mary
Attachments:	ReqAdv_G_CIS_78_2026F_3.pdf Hybrid_CIS_78_2026F.pdf Online_CIS_78_2026F.pdf ReqAdv_G_CIS_78_2026F_1.pdf ReqAdv_G_CIS_78_2026F_2.pdf
Course ID (CB01A and CB01B) :	CISD078.
Short Course Title:	INTRO TO DEEP LEARNING
Course Title (CB02) :	Introduction to Deep Learning
Department:	CIS - Computer Sci and Info Systems
Effective Term:	Fall 2026
TOP Code (CB03) :	(0707.10) *Computer Programming
CIP Code:	(11.0201) Computer Programming/Programmer, General.
SAM Priority Code (CB09) :	C - Clearly Occupational
Distance Education Approved:	Yes
Course Control Number:	No value
Curriculum Committee Approval Date:	06/17/2025
Board of Trustees Approval Date:	Pending
External Review Approval Date:	09/01/2026
Course Description:	This course introduces fundamental concepts of neural networks and deep learning, equipping students with the skills needed to develop, optimize, and deploy neural network models. Key topics include neural network architectures, backpropagation, regularization, and optimization techniques. Students will explore convolutional neural networks (CNNs) for image processing, recurrent neural networks (RNNs) for sequential data, and advanced models such as long short-term memory (LSTM) networks and gated recurrent units (GRUs).
Course Type (CB27) :	• Lower Division
Mode of Delivery:	• Online • Hybrid
Faculty Initiator:	No value
Course Family:	Not Applicable

Faculty Requirements

Discipline 1:	• Computer Science
Discipline 2:	No value

Discipline 3: No value

FSA:
- FHDA FSA - COMPUTER SCIENCE

Formerly Statement

Formerly Statement

No Value

Course Justification

Course Justification

This is a CSU transferable course. It is CTE and belongs in the Certificate of Achievement - Advanced in Applied Artificial Intelligence. This course will provide students with foundational knowledge and application of math and statistics in machine learning models.

Stand-Alone Statement

Stand-Alone Statement

No Value

Course Philosophy

Course Philosophy

The Introduction to Deep Learning course is designed to equip students with a strong foundation in neural networks and advanced machine learning models, fostering both theoretical understanding and practical proficiency. This course emphasizes a hands-on, problem-solving approach, allowing students to engage with real-world challenges in computer vision, natural language processing, and predictive modeling. We believe that deep learning is not just about mastering algorithms but also about cultivating an analytical mindset. Through coding exercises, case studies, and collaborative projects, students will develop the critical thinking skills necessary to evaluate and optimize models effectively. The course encourages exploration and experimentation, leveraging industry-standard frameworks like TensorFlow and PyTorch to bridge the gap between theory and application. Moreover, ethical considerations and societal impacts of AI are integral to our philosophy. We stress the responsible use of deep learning technologies, fostering discussions on fairness, bias, and the implications of automated decision-making. Ultimately, this course aims to inspire innovation, enabling students to harness deep learning's power for scientific discovery, business intelligence, and creative applications, preparing them for future contributions in this rapidly evolving field.

CTE Course

Is this a CTE (Career Technical Education) course?

Yes

Honors/Non-honors Course

Is this an honors/non-honors course?

No

Mirrored Credit/Noncredit Course

Is this a mirrored credit/noncredit course?

Yes - don't forget to duplicate the revisions in the mirrored credit/noncredit course

Cross-listed Course

Is this a cross-listed course?

No

Foothill Equivalency

Does the course have a Foothill equivalent?

No

Foothill Faculty Consultation Name

No Value

Foothill Course ID

No Value

Course Development Options

Basic Skill Status (CB08)

Course is not a basic skills course.

Course Special Class Status (CB13)

Course is not a special class.

Grade Options

- Letter Grade
- Pass/No Pass

Repeat Limit

0

Course Prior To College Level

Not applicable.

Repeatability Statement

No value

Course Support Status (CB26)

Course is not a support course

Associated Programs

Course is part of a program

Associated Program	Award Type	Active
Applied Artificial Intelligence Associate of Science (In Development)	Associate in Science (A.S.) Degree	Fall 2026
Applied Artificial Intelligence Certificate of Achievement - Advanced (In Development)	Certificate of Achievement-Advanced (COA-A)	Fall 2026

Transferability & Gen. Ed. Options

Course General Education Status (CB25)

Y

Transferability (CB05)

Transferable to CSU only

Transferability Status

Approved

UC Transferable and/or Lower-Division Major Requirement

Will the course be UC transferable?

No

If yes, identify the lower-division UC course and campus.

No Value

Will the course fulfill a UC/CSU lower-division major requirement?

No

If yes, identify the UC/CSU campus, course and major.

No Value

Units and Hours

Summary

Minimum Credit Units	4.5
Maximum Credit Units	4.5
Total Course In-Class (Contact) Hours	66
Total Course Out-of-Class Hours	96

Total Student Learning Hours 162

Credit / Non-Credit Options

Course Credit Status (CB04)

Credit - Degree Applicable

Course Non Credit Category (CB22)

Credit Course.

Course Classification Code (CB11)

Credit Course.

Funding Agency Category (CB23)

Not Applicable.

Cooperative Work Experience Education Status (CB10)

Variable Credit Course

Weekly Student Hours

	In Class	Out of Class
Lecture Hours	4	8
Laboratory Hours	1.5	0
NA Hours	0	0

Course Student Hours

Course Duration (Weeks)	12
Hours per unit divisor	36
Course In-Class (Contact) Hours	
Lecture	48
Laboratory	18
NA	0
Total	66
Course Out-of-Class Hours	
Lecture	96
Laboratory	0
NA	0
Total	96

Units and Hours - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
No Value	No Value	No Value	No Value

SKIP

No Value

Specifications

Methods of Instruction

Methods of Instruction	Methods of Instruction
Methods of Instruction	Collaborative learning and small group exercises Collaborative projects Discussion and problem-solving performed in class Discussion of assigned reading Homework and extended projects In-class exploration of internet sites Laboratory discussion sessions and quizzes that evaluate the proceedings weekly laboratory exercises Lecture and visual aids Quiz and examination review performed in class

Assignments

A. Reading in textbook, online references, and lecture notes.
B. 6-8 problem solving assignments on evaluating and applying machine learning models.
1. Utilize deep learning toolkits such as TensorFlow, PyTorch, and Keras to set up the environment and implement a simple feedforward neural network.
2. Perform data preprocessing techniques including data cleaning, normalization, augmentation, and feature scaling for both structured and unstructured datasets.
3. Train and evaluate supervised deep learning models by applying regularization techniques, tuning hyperparameters, and analyzing performance metrics such as accuracy and F1-score.
4. Develop and optimize convolutional neural networks for image classification, experiment with data augmentation techniques, and fine-tune pre-trained models using transfer learning.
5. Implement recurrent neural networks, LSTM, and transformers for sequential data processing, time-series forecasting, and natural language processing tasks.

Methods of Evaluation	Methods of Evaluation
Methods of Evaluation	A. Assignments and quizzes are evaluated for completeness, correctness, and proper application and evaluation of deep learning models. B. In-class problem solving and group collaborative problem solving are evaluated for the ability to apply deep learning models appropriately and interpret the results correctly. C. One or more examinations with questions on deep learning concepts and applications discussed in class, which require the student to apply deep learning models appropriately or write short answers. Submitted work will be graded on correctness and completeness. D. A comprehensive final examination with questions on deep learning concepts and applications discussed in class, which require the student to apply deep learning models appropriately or write short answers. Submitted work will be graded on correctness and completeness.

Essential Student Materials/Essential College Facilities

Essential Student Material:

- None

Essential College Facilities:

- None

Examples of Primary Texts and References

Author	Title	Publisher	Date/Edition	ISBN
Francois Chollet	Deep Learning with Python, Second Edition	Manning	December 21, 2021/2nd Edition	978-1617296864

Suggested Reading List

No Value

Learning Outcomes

Course Objectives

Define and Describe the Foundational Concepts of Deep Learning

Apply the Mathematical Principles Behind Deep Learning

Implement Basic Neural Networks and Deep Learning Models

Evaluate and Improve Deep Learning Models

Utilize Deep Learning Frameworks and Libraries Effectively

Explore Real-World Applications of Deep Learning

CSLOs

Demonstrate proficiency in implementing basic deep learning algorithms and models. Expected SLO Performance: 0.0

Apply deep learning techniques to solve real-world problems and interpret results effectively. Expected SLO Performance: 0.0

Outline

Course Outline

A. Define and Describe the Foundational Concepts of Deep Learning
    1. History and evolution of deep learning
    2. Key components of neural networks: neurons, layers, and activation functions
    3. Supervised, unsupervised, and reinforcement learning paradigms
B. Apply the Mathematical Principles Behind Deep Learning
    1. Linear algebra for deep learning (vectors, matrices, and tensor operations)
    2. Calculus for deep learning: differentiation and chain rule
    3. Probability and statistics in deep learning (loss functions, likelihood estimation)
C. Implement Basic Neural Networks and Deep Learning Models
    1. Convolutional Neural Networks (CNNs) for image data
    2. Recurrent Neural Networks (RNNs) for sequential data
    3. Long Short-Term Memory (LSTM) and Gated Recurrent Units (GRU)
    4. Overfitting, underfitting, and techniques to address them
D. Evaluate and Improve Deep Learning Models
    1. Explain the purpose of Model Evaluation Metrics
    2. Define the key metrics: accuracy, precision, recall and F1-score with pre-trained models for classifying a data set.
    3. Introduce learning curves (Training and Validation loss vs. epochs), usage of overfitting, underfitting and optimal training.
    4. Introduce debugging techniques by analyzing misclassified samples and exploration of parameter tuning.
E. Utilize Deep Learning Frameworks and Libraries Effectively
    1. Explore the purpose and functionality of popular frameworks like TensorFlow, PyTorch, and Keras, emphasizing their role in building, training, and evaluating deep learning models effectively.
    2. Learn to set up a robust deep learning environment, including GPU/TPU acceleration, to optimize model training and understand its impact on key evaluation metrics such as accuracy, precision, recall, and F1-score.
    3. Understand essential evaluation metrics using pre-trained models for data classification, and analyze learning curves to assess training and validation losses, addressing concepts like overfitting, underfitting, and achieving optimal training.
    4. Delve into debugging strategies by analyzing misclassified samples and fine-tuning parameters to improve model performance while aligning with evaluation metrics and overall model efficiency.
F. Explore Real-World Applications of Deep Learning
    1. Computer Vision, Natural Language Processing, and Generative Models (GANs)
    2. Ethical considerations and societal impacts of deep learning applications

Lab Outline

A. Utilize deep learning toolkits such as TensorFlow, PyTorch, and Keras to set up the environment and implement a simple feedforward neural network.
B. Perform data preprocessing techniques including data cleaning, normalization, augmentation, and feature scaling for both structured and unstructured datasets.
C. Train and evaluate supervised deep learning models by applying regularization techniques, tuning hyperparameters, and analyzing performance metrics such as accuracy and F1-score.
D. Develop and optimize convolutional neural networks for image classification, experiment with data augmentation techniques, and fine-tune pre-trained models using transfer learning.
E. Implement recurrent neural networks, LSTM, and transformers for sequential data processing, time-series forecasting, and natural language processing tasks.

Blue Form

For changes to the units and hours tab; 1) Contact the Curriculum Office at curriculum@fhda.edu with the course information changes; and 2) address items 1-3 below. Please be aware that load factors and seat counts are assigned based on established, negotiated values.

No Value

1. Is the unit(s) change required for articulation?

No Value

2. If the course is UC or CSU transferable, identify one UC or CSU campus with the same unit value requested and copy and paste the catalog description of the course.

No Value

3. Identify the areas in the course outline of record that justify the unit(s) and/or hour(s) change.

No Value

Office Use ONLY: For a REVISION, state the existing unit(s); lec hour(s) and load; lab hour(s) and load; and seat count.

No Value

Office Use ONLY: For a REVISION, state the new unit(s); lec hour(s) and load; lab hour(s) and load; and seat count.

No Value

Office Use ONLY: For NEW, state the unit(s); lec hour(s) and load; lab hour(s) and load; and seat count.

- Units: 4.5
- Lec Hrs: 4
- Lec Load: .089
- Lab Hrs: 1.5
- Lab Load: .024
- Total Load: .113
- Seat Ct: 40
- (mkct 5/23/25)

Req/Adv

Prerequisite(s):

CIS D017A and (CIS D017B, MATH D002B or MATH D02BH)

Corequisite(s):

No Value

Advisory(ies):

No Value

Advisory(ies) - Other:

No Value

Limitation(s) on Enrollment:

No Value

Limitation(s) on Enrollment - Other:

No Value

Entrance Skills(s):

No Value

Entrance Skill(s) - Other:

No Value

General Course Statement(s):

No Value

General Course Statement(s) - Other:

No Value

A-Matrix Form

EWRT D001A or EWRT D01AH or ESL D005. If this is the requisite for the course, complete the objective(s) below. If this requisite is being removed, provide an explanation as to why.

No Value

Objective 1: Analyze college level texts and discourse that are culturally and rhetorically diverse.

No Value

Objective 2: Compose essays drawn from personal experience and assigned texts.

No Value

Objective 3: Utilize MLA guidelines to format essays, cite sources, and compile a works cited page.

No Value

Objective 4: Create syntactically varied sentences that are free of mechanical errors.

No Value

Objective 5: Distinguish, compare, and evaluate the multiplicity and ambiguity of perspectives.

No Value

B-Matrix Form

ESL D272. and ESL D273., or ESL D472. and ESL D473., or eligibility for EWRT D001A or EWRT D01AH or ESL D005. If this is the requisite for the course, complete the objective(s) below. If this requisite is being removed, provide an explanation as to why.

No Value

Objective 1: Analyze a variety of college-level texts with a focus predominantly on expository and argumentative writing.

No Value

Objective 2: Develop analytical ideas and topics for essays.

No Value

Objective 3: Compose and support thesis statements for analytical essays.

No Value

Objective 4: Develop clear sequential relationship between central argument/controlling idea and supporting ideas in writing.

No Value

Objective 5: Identify and practice writing for different audiences and purposes.

No Value

Objective 6: Develop and demonstrate a variety of rhetorical strategies to develop strong analysis in essays.

No Value

Objective 7: Demonstrate writing as a multi-step process including attention to planning and revision.

No Value

Objective 8: Practice composing organized, developed, analytical essays that increase in complexity.

No Value

Objective 9: Demonstrate appropriate grammar usage and mechanics.

No Value

C-Matrix Form

ESL D261. and ESL D265., or ESL D461. and ESL D465., or eligibility for EWRT D001A or EWRT D01AH or ESL D005. If this is the requisite for the course, complete the objective(s) below. If this requisite is being removed, provide an explanation as to why.

No Value

Objective 1: Create compositions about fiction and non-fiction texts from many cultural and social perspectives in a variety of genres.

No Value

Objective 2: Compose a focused, purposeful, developed paper of 500 words or more that engages with, responds to, or is inspired by written or visual texts.

No Value

Objective 3: Produce written work using a cyclical process of multiples drafts and revisions.

No Value

Objective 4: Demonstrate the ability to include a variety of sentence structures in writing.

No Value

Objective 5: Edit compositions to correct errors in the major conventions of Standard Written English.

No Value

D-Matrix Form

Intermediate algebra or equivalent (or higher), or appropriate placement beyond intermediate algebra. If this is the requisite for the course, complete the objective(s) below. If this requisite is being removed, provide an explanation as to why.

No Value

Objective 1: Plan, implement, and assess work cycles, at the problem, lesson, module, and course level, to develop self-efficacy through the practice of self-regulated learning.

No Value

Objective 2: Investigate the use of mathematics in real world.

No Value

Objective 3: Explore functions.

No Value

Objective 4: Develop linear function models.

No Value

Objective 5: Use systems of two linear equations to solve real world problems.

No Value

Objective 6: Use linear inequalities in one variable to solve real world problems.

No Value

Objective 7: Examine exponential expressions and develop exponential function models.

No Value

Objective 8: Examine logarithmic expressions and develop logarithmic function models.

No Value

Objective 9: Develop quadratic function models to solve problems.

No Value

Objective 10: Investigate the characteristics of rational expressions.

No Value

Objective 11: Develop skills to work with radical expressions.

No Value

E-Matrix Form

Elementary algebra or equivalent (or higher), or appropriate placement beyond elementary algebra. If this is the requisite for the course, complete the objective(s) below. If this requisite is being removed, provide an explanation as to why.

No Value

Objective 1: Develop, throughout the course as applicable, systematic problem-solving methods.

No Value

Objective 2: Explore the function concept algebraically, numerically, verbally and graphically.

No Value

Objective 3: Explore the graphical and numerical characteristics of linear relationships and describe their meaning in the context of a problem.

No Value

Objective 4: Develop linear function models to solve problems.

No Value

Objective 5: Use systems of two linear equations to solve real-world problems.

No Value

Objective 6: Explore the graphical and numerical characteristics of quadratic relationships and describe their meaning in the context of a problem.

No Value

Objective 7: Develop quadratic function models to solve problems.

No Value

Objective 8: Use inequalities to solve real world problems.

No Value

Objective 9: Explore arithmetic sequences and series.

No Value

Objective 10: Investigate, throughout the course as applicable, how mathematics has developed as a human activity around the world.

No Value

F-Matrix Form

Pre-algebra or equivalent (or higher), or appropriate placement beyond pre-algebra. If this is the requisite for the course, complete the objective(s) below. If this requisite is being removed, provide an explanation as to why.

No Value

Objective 1: Develop, throughout the course as applicable, systematic problem solving methods.

No Value

Objective 2: Solve problems involving arithmetic operations, including fractions, percents and decimals.

No Value

Objective 3: Apply the order of operations to evaluate signed numerical expressions.

No Value

Objective 4: Solve problems involving operations with signed numbers.

No Value

Objective 5: Explore the characteristics and properties of real numbers.

No Value

Objective 6: Use estimation to determine approximate solutions and to check the reasonableness of answers.

No Value

Objective 7: Explore rates and ratios and use proportions to solve problems.

No Value

Objective 8: Explore, as applicable throughout the course, the geometry of mathematical measurements and solve problems involving geometric figures and formulas.

No Value

Objective 9: Explore the use of variables in expressions and evaluate algebraic expressions.

No Value

Objective 10: Solve linear equations in one variable numerically and algebraically.

No Value

Objective 11: Graph linear relationships on a Cartesian coordinate by plotting ordered pairs.

No Value

Objective 12: Investigate, throughout the course as applicable, how mathematics has developed as a human activity around the world.

No Value

G-Matrix Form

If the requisite does not fall under an A-F Matrix and is being removed, provide an explanation as to why.

No Value

If the requisite does not fall under an A-F Matrix and is being retained/added, download the Content Review Matrix G from the Reference Materials, and follow the remaining instructions on the form. Reminder that: an "OR" conjunction statement requires ONE representative G-Matrix; an "AND" conjunction statement requires a separate G-Matrix for EACH course.

No Value

H-Matrix Form

Objective 1: For entrance into a CTE program such as Nursing, AUTO, APRN, etc... list the prerequisite(s) to participate in the program.

No Value

Objective 2: For Student Cohorts, such as Honors, Puente, performance groups, intercollegiate teams, Special Projects course, etc... list the prerequisite(s) to participate in the cohort.

No Value

Objective 3: For Prerequisites based on Government/Licensing/Certification Regulations, or legal requirements, cite the regulation that mandates a prerequisite or attach a copy of it to this form.

No Value

Objective 4: For Requirements based on Health and Safety, describe the specific skills, concepts, and information without which the students would create a hazard to themselves or those around them. Also describe how students will meet those skills.

No Value

Objective 5: For Entrance Skills that are necessary for taking the course, describe the specific skills and the reason they are necessary for this course. Also describe how students will meet those skills.

No Value

Objective 6: For other Limitations on Enrollment not covered above, indicate the limitation on enrollment and the reason it is necessary for this course. Also describe how students will be able to meet the requirement.

No Value

De Anza GE Form

Criteria 1: Present core concepts and scope that define the discipline. (ONLY using the Outline, Assignments or Methods of Evaluation areas, cite, copy and paste the area referenced.)

No Value

Criteria 2: Foster oral and written communication and collaborative exercises. Note that this criteria has three separate pieces: oral communication, written communication, and collaborative exercises. (ONLY using the Outline, Assignments or Methods of Evaluation areas, cite, copy and paste the area referenced.)

No Value

Criteria 3: Stimulate critical thinking. (ONLY using the Outline, Assignments or Methods of Evaluation areas, cite, copy and paste the area referenced.)

No Value

Criteria 4: Include diverse perspectives and contributions in the discipline such as: gender, culture, values, and/or societal perspectives. (ONLY using the Outline, Assignments or Methods of Evaluation areas, cite, copy and paste the area referenced.)

No Value

Criteria 5: Provide global and historical context. (ONLY using the Outline, Assignments or Methods of Evaluation areas, cite, copy and paste the area referenced.)

No Value

Criteria 6: Use real-world or hands-on applications that will provide a context for the concepts being discussed. (ONLY using the Outline, Assignments or Methods of Evaluation areas, cite, copy and paste the area referenced.)

No Value

Comments

Stage 2: Department Chair

No Value

Stage 3: Division Curriculum Representative

No Value

Stage 4: Division Dean

No Value

Stage 5: SLO Coordinator

No Value

Stage 7: Content Review Matrix Liaison

No Value

Stage 8: Dean of Online Learning

No Value

Stage 9: Articulation Officer

No Value

Stage 10: De Anza General Education

No Value

Stage 13: Curriculum Committee

No Value

CO

Sort ID (00 < 10; 0 < 100)

CIS 078

Course Status

New

Course Characteristics

- CTE

Cross-Listed/Related Course Information

- NA

Cross-Listed/Related Course ID's

No Value

DL Approval Date (MM/DD/YYYY)

06/17/2025

Hybrid Approval Date (MM/DD/YYYY)

06/17/2025

Curriculum Office Notes

No Value