

# **바이오헬스 혁신공유대학**

## **교과목 개발 및 운영 계획서**

<b>교 과 목 명</b>	<b>의료영상과 딥러닝의 이해</b>
<b>교 강 사 명</b>	<b>Understanding Medical Imaging and Deep Learning</b>
<b>소           속</b>	<b>Madhusudan Singh</b>

**2022-2학기**

※ 이 교과목은 교육부 및 한국연구재단의  
디지털 신기술 인재양성 혁신공유 대학 사업비로 개발되었음

# 교과목 운영 계획서 제출문

사업명	디지털 신기술 인재양성 혁신공유 대학 사업(바이오헬스 분야)			
개설대학				
교육과정				
교과목명	국문			
	영문			
개발자 정보	소속		성명	직위(직급)
	책임			
	공동			
교과목 정보	개설학기	2022-2학기		
	수강학년			

본 교과목 개발보고서는 『디지털 신기술 인재양성 혁신공유 대학 사업(바이오 헬스 분야)』 2차년도 운영 교과목의 사전계획서로 제출합니다.

2022년 7월 2일

운영책임자 : [인]

## 1. 수업 개요(요약)

교과목 정보	교과목명(국문)		의료영상과 딥러닝의 이해		교과목명(영문)		Understanding Medical Imaging and Deep Learning	
	전공명		<input type="checkbox"/> 디자인 <input type="checkbox"/> 디바이스 <input checked="" type="checkbox"/> 데이터		학점		<input type="checkbox"/> 2학점 <input checked="" type="checkbox"/> 3학점	
	수준		<input type="checkbox"/> 초급 <input checked="" type="checkbox"/> 중급 <input type="checkbox"/> 고급					
교강사 정보	주강사	소속	Madhusudan Singh			부강사	소속	
		성명	Woosong University				성명	
		연락처					연락처	
		E-MAIL	msingh@endicott.a c.kr				E-MAIL	
수업내용	수강학년	<input type="checkbox"/> 1학년 <input checked="" type="checkbox"/> 2학년 <input type="checkbox"/> 3학년 <input type="checkbox"/> 4학년 이상						
	원어강의	<input checked="" type="checkbox"/> 영어A: 100% 영어를 사용하여 진행되는 수업(강의자료, 시험, 과제 등 포함) <input type="checkbox"/> 영어B: 50% 이상의 영어를 사용하여 진행되는 수업 <input type="checkbox"/> 해당 사항 없음						
	강의방식	<input type="checkbox"/> 팀티칭 <input type="checkbox"/> 옴니버스 티칭 <input checked="" type="checkbox"/> 상기 해당 사항 없음						
강의유형	<input checked="" type="checkbox"/> 이론강의 <input checked="" type="checkbox"/> MP(Micro Project) 전공 탐색 위한 도전적 퀴즈, 소단위 프로젝트, 실습 기반 마이크로 프로젝트 진행							
	<input type="checkbox"/> AP(Augmented Project) VR/AR의 AP를 개발, 활용하여 관련 실험, 실습 교육을 통해 실제상황과 유사한 현실적 경험을 유도							
	<input type="checkbox"/> LP(Living Lab Project) 바이오헬스분야에서의 제품서비스 개발, 산학연계, 지역혁신, 개인 등의 문제해결을 위한 LP 기반 연계 프로그램 개발 및 운영							
교수요청사항	분반여부	<input type="checkbox"/> 예(      개 분반)			<input type="checkbox"/> 아니오			
	실시간 강의	<input type="checkbox"/> 오프라인 <input checked="" type="checkbox"/> 온라인실시간강의(라이브) <input checked="" type="checkbox"/> 온라인실시간강의(홀로그램)						
사전 녹화형 강의		<input checked="" type="checkbox"/> 동영상 강의 <input type="checkbox"/> 실감형콘텐츠(AR/VR)						

외부연계	<input type="checkbox"/> 타부처 콘텐츠 활용				
	<input type="checkbox"/> 기업/유관기업 참여				
	<input type="checkbox"/> 현장실습 연계				
외부연계협력기관정보	기관명	우송대학교 AI빅데이터학과		성명	Madhusudan Singh
	직 위	Assistant Professor			
	Tel	042-629-6618			
	e-mail	msingh@wsu.ac.kr			
	역 할	<input type="checkbox"/> 교과목 공동개발	<input type="checkbox"/> 교과목 공동운영	<input type="checkbox"/> 교과목 자문	<input type="checkbox"/> 특강
		<input type="checkbox"/> 학생 멘토링	<input type="checkbox"/> 학생 컨설팅	<input type="checkbox"/> 기타: ( )	
<p style="text-align: center;"><b>※ 개인정보수집활용 동의(필수)</b></p> <p>본인은 문제해결형 교과목 개발 및 운영의 공모에 지원함에 있어 제출한 인적사항 및 강의계획서 등의 자료가 문제해결형 교과목 개발 및 운영 지원을 위해 활용될 필요가 있다는 것을 이해하고 있으며, 이를 위해 본인의 정보를 바이오헬스 혁신공유대학에 제공하는 데 동의합니다.</p> <p style="text-align: center;"><input checked="" type="checkbox"/> 동의함    <input type="checkbox"/> 동의하지 않음</p>					

## 2. 수업 개요(상세)

### 1) 기본 정보

<b>교과목 개요</b>		The main contents of this course is finding the issues and important concepts relating to deep learning technology in the digital healthcare system are covered in more detail throughout this course. It will provide in-depth information about handling and managing healthcare data with deep learning methods.				
<b>학습목표</b>		The key objective of this course is to explore the concepts of deep learning, along with recent research developments in healthcare sectors. The course includes chapters by authors who are experts in this area and have experience of the recent research developments in the field of healthcare using deep learning technology. It will provide in-depth information about the applications and utilizations of machine learning in healthcare. It will provide a better understanding of the processing of big data from the healthcare sector as used in machine learning processes, and it will highlight the links between machine learning and computer science in healthcare applications from many perspectives.				
<b>주요주제</b>		Deep Learning, Neural Networks, Medical Imaging, Healthcare System the				
<b>선수과목</b>		Understanding basics of Machine Learning, Neural Networks algorithms				
<b>준비사항</b>		※ 본 수업의 진행 과정에서 사전에 준비되어야 할(SW 등) 혹은 염두에 두어야 할 부분이 있다면 작성해주시시오.				
<b>장애학생 수업안내</b>		본 강의를 수강하는 장애 학생들에게는 장애 학생 개개인의 특성과 요구에 따라 수업 담당 교강사와의 상담을 통하여 적절한 수준의 지원 서비스(시험시간 연장 및 시험방법 조정 등)를 제공할 수 있습니다.				
<b>교재</b>	<b>순번</b>	<b>교재명</b>	<b>저자</b>	<b>출판사</b>	<b>ISBN</b>	<b>가격</b>
	1	Deep Learning for Medical Image Analysis	S. Kevin Zgou, Hayit Greenspan, Dinggang Shen	Academic Press, Elsevier	978-0-12-810408-8	
<b>부교재</b>	<b>순번</b>	<b>교재명</b>	<b>저자</b>	<b>출판사</b>	<b>ISBN</b>	<b>가격</b>
	1	Demystifying Big Data, Machine Learning and Deep Learning for Healthcare Analytics	Pradeep N, Sandeep Kautish, Sheng-Lung Peng	Academic Press, Elsevier	978-0-12-821633-0	
	2	Deep Learning in Medical Image Analysis, Challenges and Applications	Gobert Lee, Hiroshi Fujita	Book Series - Advances in Experimental Medicine and Biology, Springer, ISBN	978-3-030-33128-3	
<b>수업자료</b>	<b>순번</b>	<b>자료</b>				
	1	The course teaches in the field of healthcare using machine learning technology. It will provide in-depth information about the applications and utilizations of machine learning in healthcare.				
	2	<p>It will provide a better understanding of the processing of big data from the healthcare sector as used in machine learning processes, and it will highlight the links between machine learning and computer science in healthcare applications from many perspectives.</p> <ul style="list-style-type: none"> <li>▪ A deeper understanding of various machine learning uses and their implementation within wider healthcare.</li> <li>▪ The ability to implement machine learning systems, such as cancer detection, and enhanced deep learning.</li> <li>▪ How to select learning methods and tuning for use in healthcare.</li> <li>▪ How to recognize and prepare for the future of machine learning in healthcare through best practices, feedback loops, and intelligent agents.</li> </ul>				

핵심역량	핵심역량	역량정의	비율(100%)
	인간사회공감력	생명과 환경을 존중하며, 지역사회와 인류에 공헌하려는 덕성	20%
	상호소통능력	다양한 이해관계자, 타 학문분야와의 소통을 토대로 바이오헬스 분야의 조화로운발전에 기여하는 능력	20%
	디지털 융합력	다양한 관점·생각, 빠르게 변하는 기술·트렌드에 민첩하고 유연하게 대응하는 능력	20%
	창조적 문제해결력	바이오헬스 분야에 대한 학술·실무적 이해를 토대로 발휘하는 창의적인 응용력	20%
	자기점검능력	지속가능한 윤리적 전문가가 되기 위하여 배우고 성찰하는 주도적 태도	20%

## 2) 주차별 수업 내용

주차	수업 내용		수업 형태
1	주제	Foundations of healthcare informatics	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Goals of healthcare informatics, Focus of healthcare informatics, Applications of healthcare informatics, Medical information, Clinical decision support systems, Developing clinical decision support systems, Healthcare information management, Control flow	
2	주제	Smart healthcare systems using big data	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Big data analytics in healthcare, Big data for biomedicine, Role of sensor technology for eHealth, Major applications and challenges	
3	주제	Big data-based frameworks for healthcare systems,	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	The role of big data in healthcare systems and industry, Big data frameworks for healthcare systems, Overview of big data techniques and technologies supporting healthcare systems, big data platform and tools for healthcare	
4	주제	Predictive analysis and modeling in healthcare systems	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Process configuration and modeling in healthcare systems, Basic techniques of process modeling and prediction, Event log, Control perspective of hospital process using various, Predictive modeling control flow of a process using	
5	주제	An Introduction to Neural Networks and Deep Learning	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Feed-Forward Neural Networks, Convolutional Neural Networks, Deep Models, Tricks for Better Learning, Open-Source Tools for Deep Learning	
6	주제	An Introduction to Deep Convolutional Neural Nets for Computer Vision	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Convolutional Neural Networks, Depth, Learning Algorithm, Tricks to Increase Performance, Putting It All Together: AlexNet, Using Pre-Trained CNNs, CNN Flavors, Software for Deep Learning	
7	주제	Multi-Instance Multi-Stage Deep Learning for Medical Image Recognition	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상)
	세부내용	Problem Statement and Framework Overview, Learning	

주차	수업 내용		수업 형태
		Stage I: Multi-Instance CNN Pre-Train, Learning Stage II: CNN Boosting, Run-Time Classification, Image Classification on Synthetic Data, Body-Part Recognition on CT Slices	동영상) <input type="checkbox"/> 비대면(실시간)
8	주제	Mid-Term Exams	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Online	
9	주제	1-Dimensional Convolution Neural Network Classification Technique for Gene Expression Data	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Gene expression data, Deep learning, Convolution neural network, Machine learning, Classification	
10	주제	Classification of Sequences with Deep Artificial Neural Networks: Representation and Architectural Issues	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Deep Neural Network (DNN) models, metagenomics, chromatin organization, DNA sequences are the basic data type that is processed to perform a generic study of biological data analysis	
11	주제	Deep Cascaded Networks for Sparsely Distributed Object Detection from Medical Images	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Coarse Retrieval Model, Mitosis Detection from Histology Images, Cerebral Microbleed Detection from MR Volumes	
12	주제	A Deep Learning Model for MicroRNA - Target Binding	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Deep Learning, Recurrent Neural Networks, Long-Short Term, Memory Sequence Alignment, miRNA, target prediction, miRNA target site	
13	주제	Recurrent Neural Networks Architectures for Accidental Fall Detection on Wearable Embedded Devices	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Fall detection · Recurrent neural networks · Embedded wearable devices	
14	주제	Medical Image Retrieval System Using Deep Learning Techniques	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상) <input type="checkbox"/> 비대면(실시간)
	세부내용	Content-based image retrieval, Deep learning, Feature extraction, Machine learning, Semantic feature-based image retrieval, Similarity matching, Text-based image retrieval	
15	주제	Final Term Exam	<input type="checkbox"/> 대면 <input checked="" type="checkbox"/> 비대면(사전녹화 동영상)
	세부내용	Online	



주차	수업 내용		수업 형태
			<input type="checkbox"/> 비대면(실시간)

### 3) 과제 및 평가 계획

※ 바이오헬스 혁신공유대학의 모든 교과목은 실무역량 강화를 위하여 바이오헬스 산업 현장에 적용 가능한 연계성이 높은 특화형 과제를 3개 이상 제시하여 주십시오. 또한 우수 과제 예시 및 평가 기준을 안내하여주시기 바랍니다(실습과제 및 평가기준 작성에 대한 별도 예시 파일 반드시 참조).

평가 항목	평가항목		비율		평가항목		비율	
	출석		20%		수시고사		%	
	과제		%		중간고사		20%	
	토론		%		기말고사		40%	
	팀 프로젝트		%		학습 참여도		20%	
	기타 평가항목						%	
	합계						100 %	
과제 1	과제 내용	Understanding Bio/Healthcare using Deep Learning 1. Write the report on Deep Learning process in Medical Imaging 2. Write an example cancer imaging analysis using deeplearning						
	평가 기준	1. Understanding the field of biohealth imaging using deep learning (25%) 2. The level of creativity of ideas using dep learning model such as neural networks (25%) 3. The degree of contribution of the idea to the bio-health sector (25%) 4. Feasibility of ideas (25%)						

## **Class Syllabus in English**

<b>Course Name</b>	<b>Understanding Bio/Medical Healthcare using Deep Learning</b>
<b>Faculty Name</b>	<b>Madhusudan Singh</b>
<b>Affiliation</b>	<b>Department of AI &amp; Big Data, Woosong University</b>

**2022-2**

## 1. Class Syllabus(Summary)

Course Information	Course Name		Understanding Bio/Medical Healthcare using Deep Learning						
	Major in Course		<input type="checkbox"/> Design <input type="checkbox"/> Device <input type="checkbox"/> Data	Credit		<input type="checkbox"/> a 2-credit class <input checked="" type="checkbox"/> a 3-credit class			
	Course Level		<input type="checkbox"/> Beginning <input checked="" type="checkbox"/> Intermediate <input type="checkbox"/> Advanced						
Information about the Faculty	Main Faculty	Department	AI & Big Data	Co-Faculty	Department				
		Name	Madhusudan Singh		Name				
		Contact	042-629-6618		Contact				
		E-MAIL	<a href="mailto:msingh@endicott.ac.kr">msingh@endicott.ac.kr</a>		E-MAIL				
Course Progression	School Year	<input type="checkbox"/> Freshman <input checked="" type="checkbox"/> Sophomore <input type="checkbox"/> Junior <input type="checkbox"/> Senior							
	Language	<input checked="" type="checkbox"/> 100% taught in English							
		<input type="checkbox"/> More than 50% taught in English							
		<input type="checkbox"/> 100% taught in Korean							
	Lecture Type	<input type="checkbox"/> Team Teaching							
		<input type="checkbox"/> Omnibus Teaching							
		<input checked="" type="checkbox"/> None of them							
	Lecture Method	<input checked="" type="checkbox"/> Theory-Focused Lecture							
		<input checked="" type="checkbox"/> MP(Micro Project)							
		<input type="checkbox"/> AP(Augmented Project)							
		<input type="checkbox"/> LP(Living Lab Project)							
	A Class Divided	<input checked="" type="checkbox"/> Yes(A Division into ( 2 ) Classes)		<input type="checkbox"/> No					
Instructional Media	A Real-Time Class	<input type="checkbox"/> An Offline Class							
		<input checked="" type="checkbox"/> A Real-Time(live) Online Class							
		<input type="checkbox"/> A Real-Time Hologram Class							

	<b>A Pre-Recorded Class</b>	<input checked="" type="checkbox"/> An Online Class on Video Recording			
		<input type="checkbox"/> An Online Class on Augmented/Virtual Reality			
<b>Collaboration with Other Organizations</b>	<input type="checkbox"/> Utilizing Contents from Government-Related				
	<input type="checkbox"/> Cooperating with External Institutions				
	<input type="checkbox"/> Industry Field Training				
<b>Co-operative Institutions</b>	<b>Institution</b>				
	<b>Name</b>		<b>Position</b>		
	<b>Tel</b>				
	<b>e-mail</b>				
	<b>Role</b>	<input type="checkbox"/> Co-developing Curriculum	<input type="checkbox"/> Co-teaching	<input type="checkbox"/> Teaching Advice	<input type="checkbox"/> Special Lectures
		<input type="checkbox"/> Student Mentoring	<input type="checkbox"/> Student Consulting	<input type="checkbox"/> Etc. (                      )	
<b>※ Agreement on the Collection-Use-Provision of Personal Information</b>					
<p>I understand that the personal information and syllabus submitted when applying for the development and operation of problem-solving subjects may be used to support the development and operation of problem-solving subjects, and I agree to provide my information to Biohealth Innovation Sharing University.</p>					
<input checked="" type="checkbox"/> Agree <input type="checkbox"/> Disagree					

## 2. Class Syllabus(In Detail)

### 1) Basic Information

<b>Course Outline</b>		<b>Understanding Bio/Medical Healthcare Imaging using Deep Learning</b>				
<b>Learning objectives</b>		<p>The course teaches in the field of healthcare using deep learning technology. It will provide in-depth information about the applications and utilizations of deep learning methods neural networks in healthcare. It will provide a better understanding of the processing of healthcare imaging data from the healthcare sector as used in deep learning processes, and it will highlight the links between deep learning and computer science in healthcare applications from many perspectives.</p> <p>§ A deeper understanding of various deep learning models uses and their implementation within wider healthcare.</p> <p>§ The ability to implement deep learning systems, such as cancer detection, and enhanced deep learning.</p> <p>§ How to select learning methods and tuning for use in healthcare imaging.</p> <p>§ How to recognize and prepare for the future of deep learning in healthcare through best practices, feedback loops, and intelligent agents.</p>				
<b>Keywords in Class</b>		<b>Deep Learning, Neural Networks, Medical Imaging, Healthcare System</b>				
<b>Prerequisites</b>		<b>Understanding basics of Machine Learning, Neural Networks algorithms</b>				
<b>Notice for Students</b>		<b>Bio Health LMS, SMS, etc..</b>				
<b>Course Guide for Disabled Students</b>		For students with disabilities taking this course, we can provide appropriate level of support services (extension of test time and adjustment of test methods, etc.) through consultation with the class instructor according to the characteristics and needs of each student with disabilities.				
<b>Main Text Book</b>	<b>No.</b>	<b>Textbook Name</b>	<b>Author</b>	<b>Publishing Company</b>	<b>ISBN</b>	<b>Price(¥)</b>
	<b>1</b>	Deep Learning for Medical Image Analysis	S. Kevin Zgou, Hayit Greenspan, Dinggang Shen	Academic Press, Elsevier	978-0-12-810408-8	
<b>Supplementary Textbook</b>	<b>No.</b>	<b>Textbook Name</b>	<b>Author</b>	<b>Publishing Company</b>	<b>ISBN</b>	<b>Price(¥)</b>
	<b>1</b>	Demystifying Big Data, Machine Learning and Deep Learning for Healthcare Analytics,	Pradeep N, Sandeep Kautish, Sheng-Lung Peng	Academic Press, Elsevier	978-0-12-821633-0	
	<b>2</b>	Deep Learning in Medical Image Analysis, Challenges and Applications	Gobert Lee, Hiroshi Fujita	Book Series-Advances in Experimental Medicine and Biology, Springer, ISBN	978-3-030-33128-3	
<b>Teaching</b>	<b>No</b>	<b>Teaching Materials</b>				

<b>Material</b>	<b>1</b>	The course teaches in the field of healthcare using machine learning technology. It will provide in-depth information about the applications and utilizations of machine learning in healthcare.	
	<b>2</b>	<p>It will provide a better understanding of the processing of big data from the healthcare sector as used in machine learning processes, and it will highlight the links between machine learning and computer science in healthcare applications from many perspectives.</p> <ul style="list-style-type: none"> <li>▪ A deeper understanding of various machine learning uses and their implementation within wider healthcare.</li> <li>▪ The ability to implement machine learning systems, such as cancer detection, and enhanced deep learning.</li> <li>▪ How to select learning methods and tuning for use in healthcare.</li> <li>▪ How to recognize and prepare for the future of machine learning in healthcare through best practices, feedback loops, and intelligent agents.</li> </ul>	
<b>Core Competency</b>	<b>The Five Core Competencies (5S)</b>	<b>Definition</b>	<b>Ratio(100%)</b>
	Society empathy competency (SOFT)	Virtue to respect life and the environment, and to contribute to the local community and humanity	<b>20%</b>
	Communication Competency (SUPER)	Ability to contribute to the harmonious development of the bio-health field based on communication with various stakeholders and other academic fields	<b>20%</b>
	Digital Convergence Competency (SMART)	Ability to respond quickly and flexibly to rapidly changing technology and trends with diverse perspectives and ideas	<b>20%</b>
	Creative Problem Solving Competency (STAR)	Creative application skills based on academic and practical understanding of the bio-health field	<b>20%</b>
	Self-Reflective Competency (STRATEGIC)	Active attitude to learn and reflect to become a sustainable ethics expert	<b>20%</b>

## 2) Weekly Course Information

Week	Weekly Class Contents		Type of Class
<b>1</b>	<b>Main Topic</b>	Foundations of healthcare informatics	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	<b>Contents</b>	Goals of healthcare informatics, Focus of healthcare informatics, Applications of healthcare informatics, Medical information, Clinical decision support systems, Developing clinical decision support systems, Healthcare	

Week	Weekly Class Contents		Type of Class
		information management, Control flow	
2	Main Topic	Smart healthcare systems using big data	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Big data analytics in healthcare, Big data for biomedicine, Role of sensor technology for eHealth, Major applications and challenges	
3	Main Topic	Big data-based frameworks for healthcare systems,	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	The role of big data in healthcare systems and industry, Big data frameworks for healthcare systems, Overview of big data techniques and technologies supporting healthcare systems, big data platform and tools for healthcare	
4	Main Topic	Predictive analysis and modeling in healthcare systems	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Process configuration and modeling in healthcare systems, Basic techniques of process modeling and prediction, Event log, Control perspective of hospital process using various, Predictive modeling control flow of a process using	
5	Main Topic	An Introduction to Neural Networks and Deep Learning	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Feed-Forward Neural Networks, Convolutional Neural Networks, Deep Models, Tricks for Better Learning, Open-Source Tools for Deep Learning	
6	Main Topic	An Introduction to Deep Convolutional Neural Nets for Computer Vision	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Convolutional Neural Networks, Depth, Learning Algorithm, Tricks to Increase Performance, Putting It All Together: AlexNet, Using Pre-Trained CNNs, CNN Flavors, Software for Deep Learning	
7	Main Topic	Multi-Instance Multi-Stage Deep Learning for Medical Image Recognition	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Problem Statement and Framework Overview, Learning Stage I: Multi-Instance CNN Pre-Train, Learning Stage II: CNN Boosting, Run-Time Classification, Image Classification on Synthetic Data, Body-Part Recognition on CT Slices	
8	Main Topic	Mid-Term Exams	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Online	
9	Main Topic	1-Dimensional Convolution Neural Network Classification Technique for Gene Expression Data	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Gene expression data · Deep learning · Convolution neural network · Machine learning · Classification	
10	Main Topic	Classification of Sequences with Deep Artificial Neural Networks: Representation	<input type="checkbox"/> A Face-to-Face Class

Week	Weekly Class Contents		Type of Class
		and Architectural Issues	<input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Deep Neural Network (DNN) models, metagenomics, chromatin organization, DNA sequences are the basic data type that is processed to perform a generic study of biological data analysis	
11	Main Topic	Deep Cascaded Networks for Sparsely Distributed Object Detection from Medical Images	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Coarse Retrieval Model, Mitosis Detection from Histology Images, Cerebral Microbleed Detection from MR Volumes	
12	Main Topic	A Deep Learning Model for MicroRNA - Target Binding	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Deep Learning, Recurrent Neural Networks, Long-Short Term, Memory Sequence Alignment, miRNA, target prediction, miRNA target site	
13	Main Topic	Recurrent Neural Networks Architectures for Accidental Fall Detection on Wearable Embedded Devices	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Fall detection · Recurrent neural networks · Embedded wearable devices	
14	Main Topic	Medical Image Retrieval System Using Deep Learning Techniques	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Content-based image retrieval · Deep learning · Feature extraction · Machine learning · Semantic feature based image retrieval · Similarity matching · Text-based image retrieval	
15	Main Topic	Final Term Exam	<input type="checkbox"/> A Face-to-Face Class <input checked="" type="checkbox"/> An Online Class on Video Recording <input type="checkbox"/> A Real-time Online Class
	Contents	Online	

### 3) Evaluation Plan

※ It is recommended that all the subjects at Digital Bio-Health Convergence include PBL and Living Lab activities to strengthen the practical competencies.

Evaluation Item	Evaluation Item	Ratio	Evaluation Item	Ratio
	Attendance	20%	Nonscheduled Exam	%
	Report	%	MidTerm Exam	20%
	Debate	%	Final Exam	40%
	Team Project	%	Study Participation	20%
	Etc.			%
	Total			100 %