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**Presidential Initiative for Artificial Intelligence and Computing (PIAIC)**

https://www.piaic.org

**Artificial Intelligence Specialist Program**

Course Syllabus

**Quarter IV: AI-401 Advanced Computer Vision and Machine Learning Pipelines**

Version 1.0.0 - 2020 (13 Weeks)

**Teaching Team: Inam Ul Haq, Dr. Noman Islam, Anees Ahmed, Nasir Hussain, Muhammad Qasim, Khurram Raheel, Waqas Ali Munawar, Muhammad Ali, Muhammad Hamza Khan, Aqsa Abdul Qadir, Fayyaz Farooq, Gulraeez Gulshan, Hafiz Muhammad Shahid, Jalees Ur Rehman Khan, Komal Aftab, Mansoor Hussain, Mohsin Iqbal, Muhammad Ali, Muhammad Asadullah, Muhammad Hamza Khan, Muhammad Haseeb Amjad, Muhammad Shahzad Ahsan, Muhammad Sohaib, Muhammad Usman, Nehal Ahmed, Ramsha Munawarah Azeemi, Saqib Arfeen, Shafqat Soomro, Shifa-ur-Rehman Jamali, Syed Hamza, Syed Hamza Ali, Syed Muhammad Masab, Syed Wajahat Ali Naqvi, Umair Shahzad, Waqas Ali Munawar, Rauf ur Rahim, Faizan Amin, Tahir Bhatti, Adan Abid, and Arslan**

**Class Duration: 3 hours**

**Course Description:**

We will start the course by learning to build high performance systems for object detection, segmentation, and video processing. In the second half of the course the machine-learning engineers will learn how to successfully productize the deep leaning models they have built. We will cover the steps of automating a machine-learning pipeline using the TensorFlow ecosystem. You’ll learn the techniques and tools that will cut deployment time from days to minutes, so that you can focus on developing new models. You will learn in detail how to build your pipeline using components from TensorFlow Extended (TFX).

**Please bring a Laptop with you for the Classes (Required, but not mandatory)**

**Textbook:**

1. Hands-On Computer Vision with TensorFlow 2: Leverage deep learning to create powerful image processing apps with TensorFlow 2.0 and Keras by Benjamin Planche, Eliot Andres

<https://www.packtpub.com/application-development/hands-computer-vision-tensorflow-2>

Book Repo: <https://github.com/PacktPublishing/Hands-On-Computer-Vision-with-TensorFlow-2>

1. Building Machine Learning Pipelines: Automating Model Life Cycles with TensorFlow by Hannes Hapke , Catherine Nelson

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/>

Book Repo: <https://github.com/Building-ML-Pipelines/building-machine-learning-pipelines>

**Reference Books:**

1. [Linux: Easy Linux for Beginners by Felix Alvaro](https://www.amazon.com/LINUX-Beginners-Step-Step-Operating-ebook/dp/B01CF1FORK)
2. [Docker Deep Dive by Nigel Poulton](https://www.amazon.com/Docker-Deep-Dive-Nigel-Poulton-ebook/dp/B01LXWQUFF/ref=sr_1_1)
3. [Kubernetes in Action by Marko Lukša](https://www.manning.com/books/kubernetes-in-action)
4. [Learn Version Control with Git: A step-by-step course for the complete beginner by Tobias Günther](https://www.amazon.com/Learn-Version-Control-step-step-ebook/dp/B00K54OL8I/ref=sr_1_3)
5. [Kubeflow for Machine Learning by Holden Karau, Trevor Grant, Ilan Filonenko, Richard Liu, Boris Lublinsky](https://www.oreilly.com/library/view/kubeflow-for-machine/9781492050117/)

**PIAIC Announcements Facebook Group:** <https://www.facebook.com/groups/piaic/>

**Course Facebook Group:** <https://www.facebook.com/groups/deep.learning.edu/>

**Portal for online and onsite students:**

<https://portal.piaic.org/>

**Ask Questions:**

<https://ask.piaic.org/>

**Chat on Telegram:**

Group Name: PIAIC-AI

<https://t.me/piaic_ai>

**Grading:**

Students will be graded based on Percentile

<https://en.wikipedia.org/wiki/Percentile>

<https://en.wikipedia.org/wiki/Percentile_rank>

A-Grade: 78- 99 Percentile

B-Grade: 41- 77 Percentile

C-Grade: 23- 40 Percentile

D-Grade: 1 - 22 Percentile

F-Grade: Anyone who doesn’t appear in two or more exams

Note: Anyone who receives a F-Grade will be removed from the program. Students who receive a D-Grade will be put on probation, and be required to earn a grade of C or above in the next quarter, to remain in the program. Anyone absent from an exam will be deemed to have received a score of zero.

**Course Outline:**

1. Object Detection Models (Week 1)

Chapter 5 of Hands-On Computer Vision with TensorFlow 2

1. Enhancing and Segmenting Images (Week 2)

Chapter 6 of Hands-On Computer Vision with TensorFlow 2

1. Training on Complex and Scarce Datasets (Week 3)

Chapter 7 of Hands-On Computer Vision with TensorFlow 2

1. Video and Recurrent Neural Networks (Week 4)

Chapter 8 of Hands-On Computer Vision with TensorFlow 2

**Midterm Quiz I in Week 6**

**Chapters 5-8 of Hands-On Computer Vision with TensorFlow 2**

1. Introduction to Machine Learning Pipelines (Week 5)

Chapter 1 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch01.html#introduction>

1. Introduction to TensorFlow Extended (Week 6)

Chapter 2 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch02.html#tensorflow_extended>

1. Data Ingestion, Versioning and Validation (Week 7)

Chapter 3 and 4 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch03.html#data_ingestion>

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch04.html#data_validation>

1. Data Preprocessing (Week 8)

Chapter 5 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch05.html#data_preprocessing>

1. Model Training, Analysis and Validation (Week 9)

Chapter 6 and 7 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch06.html#training>

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch07.html#model_analysis>

**Midterm Quiz II in Week 10**

**Chapters 1-7 of Building Machine Learning Pipelines**

1. Model Deployment with TensorFlow Serving (Week 11)

Chapter 8 and 9 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch08.html#model_serving>

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch09.html#adv_model_deployments>

1. Apache Beam and Apache Airflow (Week 12)

Chapter 11 of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch11.html#airflow_beam_pipelines>

1. Introduction to Docker and Kubernetes on Google Cloud (Weeks 13)

Appendix A of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/app01.html#appendix_1>

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/app02.html#appendix_2>

1. Kubeflow Pipelines (Week 14)

Chapter 12 and Appendix C of Building Machine Learning Pipelines

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/ch12.html#kubeflow_pipelines>

<https://www.oreilly.com/library/view/building-machine-learning/9781492053187/app03.html#appendix_3>

**Final Quiz in Week 14**

**Chapters 7, 8, 9, 11, 12, and Appendix A, B, and C of Building Machine Learning Pipelines**