



The Abdus Salam International Centre for Theoretical Physics

**Online Training Course on
Speech and Natural Language Processing
1 – 30 June 2021**

TRAINING COURSE OUTLINE

COURSE DESCRIPTION

Title	Speech and Natural Language Processing
Objectives	The course aims to teach concepts of Automatic Speech Recognition (ASR) and Natural Language Processing.
Dates	June 1 – 30 2021
Duration	4 weeks
Registration deadline	31 st May 2021
Training fees	USD 150
Course code	21OI26500EUR-E

DESCRIPTION OF THE TRAINING COURSE

This course is designed to teach students to understand the current state of the art of Automatic Speech Recognition (ASR) and Natural Language Processing. The first part provides background review and discussion on ASR background and introduction to probability. Student will learn key algorithms such as HMM, DNN, Hybrid (HMM/DNN) and Baum-Welch training algorithm. Students will also learn about representations of the acoustic signal like MFCC coefficients, and the use of Gaussian Mixture Models (GMMs) and context-dependent triphones for acoustic modeling. Finally, we will cover N-gram language modeling and perplexity. The students will be engaged in detail ASR system development tools such as HTK, Sphinx and ESPRESSO. Students also gain an understanding of Text-to-Speech (TTS): Grapheme-to-phoneme and Prosody (Intonation, Boundaries and Duration). The students will compare and contrast past ASR techniques and the current approaches to develop ASR system.

LEARNING OUTCOMES

By the end of this course students

- Will be able understand the concepts of ASR and Natural Language Processing (Past, Present and Future) and its processes.
- Will have a deep understanding of approaches of ASR and additionally students will have a hands-on knowledge on ASR development tools.
- Will be able to develop, implement, evaluate language resources required for the development of an ASR system.
- Will be able to identify Modeling units of ASR elements that need to be identified, studied and understood such as Feature Extraction, Acoustic Models, Lexical Models, Language Models and Decoding.
- Will be able to understand the characteristics of languages which are challenging for the development of an ASR system.

TARGET POPULATION

This training activity is designed for technical and mid-level managers of Telecom Operators, Business entities and organisations who would like to better understand automated voice/speech recognition and response systems and how to implement or provide automated voice services in local languages.

ENTRY REQUIREMENTS

Engineering or Computer Science Degree
Basic experience in Programming (Python or C)

TUTORS/INSTRUCTORS

NAME OF TUTOR(S)/INSTRUCTOR(S)	CONTACT DETAILS
Solomon Gizaw Tulu	solomong@aau.edu.et
Clement Onime	onime@ictp.it

TRAINING COURSE CONTENTS

1. **Introduction to Speech Processing:** ASR, TTS; Speaker Recognition; Speech Translation; Speech Retrieval; Speech Understanding; Spoken Dialogue System.
2. **ASR:** Past, Present and Future
3. **Selected approaches and Development Tools:** Hidden Markov Model (HMM); Deep Neural Network (DNN); Hybrid HMM/DNN; End-to-End (E2E); Hidden Markov Model Toolkit (HTK); Sphinx; Kaldi; ESPRESSO
4. **Component Models and selection:** Feature Extraction; Acoustic Models; Lexical Models; Language Models; Decoding.
5. **Language Resources:** Speech Corpus, Pronunciation Dictionaries; Text Corpus
6. **Characteristics of Languages and challenges:** Ambiguity in G2P mapping; Morphological Complexity; Rare/special Phones, etc.;
7. Approaches for Under-Resourced Languages and Multi-Lingual ASR Development

TRAINING COURSE SCHEDULE

Week / Session	Topic	Exercises and interactions
Week 1	Introduction: Speech Processing & ASR	Zoom lectures, self-paced learning activities, discussion groups
Week 2	Approaches , development tools & Models	Zoom lectures, self-paced learning activities, discussion groups. Mid-Term examination
Week 3	Languages: Resources, characteristics & Challenges	Zoom lectures, self-paced learning activities, discussion groups
Week 4	Wrap-up	Submission of projects, presentations, assignments and Final examination

METHODOLOGY (Didactic approach)

The course will be conducted based on:

- Presentations
- Article Review
- Lab Assignments
- Project

EVALUATION AND GRADING

Evaluation	Weight
Mid Exam	20%
Lab Assignments	20%
Final Exam	30%
Project	30%

TRAINING COURSE COORDINATION

Course coordinator:	ITU coordinator:
Name: Clement Onime Email address: onime@ictp.it	Name: AnaMaria Meshkurti Email address: ana.maria.meshkurti@itu.int

REGISTRATION AND PAYMENT

ITU Academy portal account

Registration and payment should be made online at the ITU Academy portal. To be able to register for the course you **MUST** first create an account in the ITU Academy portal at the following address:
<https://academy.itu.int/index.php/user/register>

Training course registration

When you have an existing account or created a new account, you can register for the course online at the following link: <https://academy.itu.int/index.php/training-courses/full-catalogue/speech-and-natural-language-processing>

You can also register by finding your desired course in our training catalogue <https://academy.itu.int/index.php/training-courses/full-catalogue>

Payment

1. On-line payment

A training fee of USD 150 per participant is applied for this training. Payment should be made via the online system using the link mentioned above for training registration at <https://academy.itu.int/index.php/training-courses/full-catalogue/speech-and-natural-language-processing>.

2. Payment by bank transfer

Where it is not possible to make payment via the online system, select the option for offline payment to generate an invoice using the same link as above. Download the invoice to make a bank transfer to the ITU bank account shown below. Then send the proof of payment/copy of bank transfer slip and the invoice copy to Hcbmail@itu.int and copy the course coordinator. **All bank transaction fees must be borne by the payer.**

Failure to submit the above documents may result in the applicant not being registered for the training.

3. Group payment

Should you wish to pay for more than one participant using bank transfer and need one invoice for all of them, create an account as **Institutional Contact**. **Institutional Contacts** are users that represent an organization. Any student can request to be an institutional contact or to belong to any existing organization.

To do this, head to your profile page by clicking on the **“My account”** button in the user menu. At the bottom of this page, you should see two buttons:

- a. If you want to **become an institutional contact**, click on the **“Apply to be an Institutional Contact”** button. This will redirect you to a small form that will ask for the organization name. After you fill the name of the organization you want to represent, click on **“continue”** and a request will be created. An ITU Academy manager will manually review this request and accept or deny it accordingly.
- b. If you want to **belong to an existing organization**, click on the **“Request to belong to an Institutional Contact”** button. This will redirect you to a small form that will ask you to select the organization you want to join from an organization list. After you select the correct organization, click on **“continue”**, a request will then be created. The Institutional Contact that represents that organization will manually accept or deny your request to join the organization.

ITU BANK ACCOUNT DETAILS:

Name and Address of Bank:	UBS Switzerland AG Case postale 2600 CH 1211 Geneva 2 Switzerland
Beneficiary:	Union Internationale des Télécommunications
Account number:	240-C8108252.2 (USD)
Swift:	UBSWCHZH80A
IBAN	CH54 0024 0240 C810 8252 2
Amount:	USD 150
Payment Reference:	CoE-EUR 26500- P.40595.1.09

4. Other method of payment

If due to national regulations, there are restrictions that do not allow for payment to be made using options 1 & 2 above, please contact the ITU coordinator for further assistance.