ICT R&D Newsletter in Egypt

Arabic Speech Synthesis using Deep Neural Networks

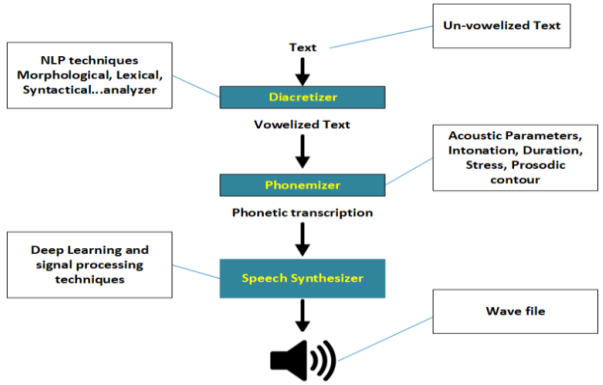
Ain Shams University

Ain Shams University ASU and researchers from Language & Speech innovation center at GTS co. have joined forces to develop a quasi-human Arabic Text To Speech (TTS) system based on state-of-the-art Deep Learning (DL) algorithms. The related applications are countless: Speech to Speech translation, chatbots, Solutions for the visually impaired, games, smart home kits, IVR automation, robotics industries and many more.

“DL has produced results comparable to and in some cases surpassing human expert performance in Automatic speech recognition, Machine translation, Image processing, Financial fraud detection etc...

Thus it’s time to apply it in speech synthesis of Arabic whose complexity is at least one order of magnitude higher than English” says Prof. Dr. Hazem Abbas, professor at ASU and the principal investigator of the project.

Merging of both Recurrent Neural Networks (RNN) and Long short-term memory (LSTM), produced impressive results in an end-to-end Arabic TTS system. The results are compared to concatenative TTS system using the Mean Opinion Score (MOS) of the synthesized speech and indicates that the developed prototype has outperformed traditional concatenative system when it comes to naturalness and intelligibility; moreover, it reduces system complexity.



Arabic TTS components based on Deep Learning

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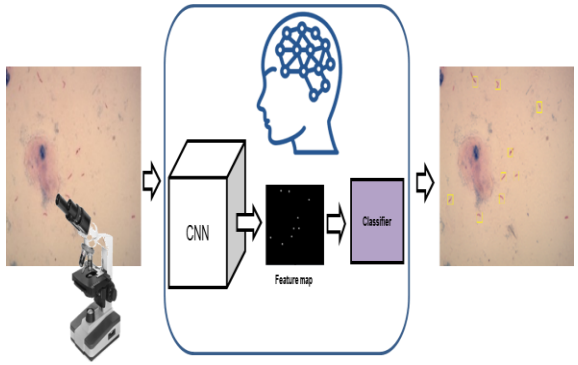
eMicroscopy for Better Tuberculosis (TB) Diagnosis

Assiut University

A research team from Assiut University has answered the call from WHO for more research on widely accessible tools for better TB diagnostics. According to WHO, TB is one of the top ten global causes of deaths and is the world's deadliest infectious killer. In 2018, about 10 million people fell ill with TB around the world with 1.5 million deaths. “One of the most widely used tests for TB diagnosis in developing parts of the world is the microscopic examination of Ziehl-Neelsen stained smears. However accurate diagnosis depends on the availability of experienced skilled lab technicians which is a problem particularly in remote rural and resource-limited regions that are mostly affected by the disease” says Dr. Tarek ElMelegy—associated professor at Assiut University Hospital and project Co-PI. He added, “That is why we are teaming up with experts in artificial intelligence for help”. Prof. Moumen El-Melegy, professor at the Engineering School and project PI, describes the eMicroscopy project as an efficient, low-cost method of diagnosing TB, turning laboratory diagnosis from art into science. In the proposed solution, a smart machine learns from the experience of skilled human experts, and is able to mimic their examination and diagnosis skills without their supervision or even their presence. This standardizes the examination of TB samples, producing consistent diagnosis result among different locations. Currently the new diagnostic tool is experimentally tested on real data at Assiut University Hospital. Both professors hope it become a standard tool in laboratories in Egypt soon.



Laboratort Diagnosis using Artificial intelligence

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Development of Microfluidic System for Miniaturized PCR Applications

EJUST University

Researchers from EJUST University has developed new techniques to analyze the DNA, which lower the cost and improving accuracy of detecting DNA molecules. DNA analysis instrument is cost-prohibitive for many laboratories, research groups, and even countries**.** **"**The DNA is the genetic code that builds and maintains hereditary information in all living organisms. DNA analysis enables uncovering secrets of the human physiology, diseases, and response to drugs and treatment." Says Dr. Ahmed Rashad, Assistant Professor at EJUST University and the principal investigator of the project. The goal of this project is to develop a platform capable of performing digital polymerase chain reaction (dPCR). At the heart of this platform, there is a microfluidic chip. The platform is performing two main functions: (1) micro-droplet formation, and (2) heat cycling of the generated droplet for amplifying DNA for each droplet. In addition, using florescence system for detection of amplified PCR products. dPCR is an evolution of real time PCR. It carries out a reaction for one single molecule. This is due to the sample is separated into hundreds of droplets each one droplet is expected to carry just one molecule. This separation allows a more reliable collection and sensitive measurement of the target DNA. This is essential for applications studying subjects with a low copy number in a large background such as cancer and genetically modified organisms (GMO). The microfluidic chip and heating system will be fabricated using Microfabrication technology at E-JUST. The testing of the platform will be done in AlexBiotechnology Company (the industrial partner in this project).

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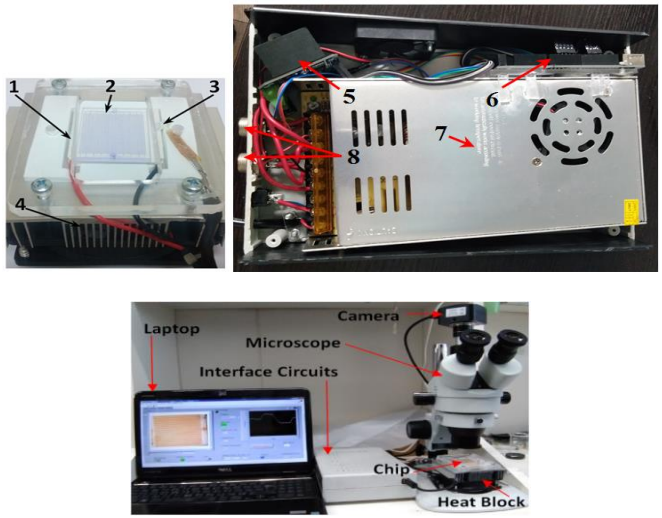

Figure 1. Photo of the heating cycle system which illustrates the main hardware system components. The left photo is the heating block using Peltier element which consists of: (1) Peltier element. (2) Proposed chip. (3) Temperature sensor. (4) Heat sink. The middle photo is the interface box which consists of: (5) Peltier driver. (6) Arduino mega 2560 board working as data acquisition. (7) Power supply. (8) Connecting sockets to heat block. The right photo is the total system setup.

An Autonomous Multi-Passenger Golf Cart

Ain Shams University

The lead of the Autotronics Research Lab and a group of researchers at the Faculty of Engineering, Ain Shams University developing an autonomous personal mobility solution based on a multi-passenger golf cart, which will be able to foster the transport technology in traffic close environments such as touristic areas, resorts, airports, hospitals, and campuses. Dr. Mohamed Abdelaziz, head of Automotive Engineering Department, Ain Shams University stated “A system of multiple autonomous unmanned ground electric vehicles can transport clients and goods around the different locations without the need of a human operator, enhancing accessibility to these centers and allowing everyone, including vulnerable users such as elderly people and those impaired with mobility to transport easily. Also, it is worth mentioning that although that wasn’t within the project’s primary objectives, such project can help in situations of pandemic since it doesn’t require human operators to transport infected people.” This project brings a concept synergy between three main technologies into the domain of personal mobility: electrification, connectivity and artificial intelligence. It integrates novel power storage capabilities that boosts vehicle electrification along with the latest intelligent autonomous transportation systems. Each vehicle is equipped with the necessary sensors for environment perception, planning, mapping and localization, and the latest generation energy batteries. The aim is to integrate some of the newest technological advances into the domain of personal mobility, and transform it, giving it a new domain that is sustainable and environment friendly. This project will further enable such know-how to be available in Egypt towards its strategic use in the future.

Autonomous Multi-Passenger Golf Cart