

## TINY AI – A GREAT STEP FOR ARTIFICIAL INTELLIGENCE DEVELOPMENT

**Maria SADOVOI**

*Technical University of Moldova, Faculty of Computers, Informatics and Microelectronics,  
group TI-206, Chişinău, Republic of Moldova*

\*Corresponding author: Maria Sadovoi [maria.sadovoi@isa.utm.md](mailto:maria.sadovoi@isa.utm.md)

**Abstract.** *One of the greatest developments that will resize the AI department and will give it a new air of utility is Tiny AI which is a focus for many in reducing, accelerating and scaling down of Artificial Intelligence. It also looks like a promising future for: Tiny Data, Tiny Hardware, Tiny Algorithms and many other possibilities. We also need to realize that it will improve the energy waste reduction. Clearly, Tiny AI will be applied in many businesses, which will improve many departments in many areas of life. Tiny AI is a development in service, data, algorithms, data structures and privacy, that is the new change for the future.*

**Keywords:** *Tiny AI, technology, artificial intelligence, future, energy, improvements.*

### **Introduction.**

In a world full of technology, where we are used to wake up with a phone in our hands and end our day at the office working at the laptop, we tend to forget that there is a new dimension that is about to make a revolution in our future. Beyond our bright minds and our logics there is AI (Artificial Intelligence), something that was beyond maybe even above our imagination, but now it is developing in front of our eyes, it evolves. But imagine having all the tech that involves (AI) at the grab of your hands. Here is where Tiny AI comes in, the future that will resize, customize and even offer a greener future to our planet.

### **What is tiny AI?**

Does the word RAS sound familiar? It stands for three simple words: accelerate, reduce and scale down. These are the bases of tiny AI and the strong pillars that hold this domain. Tiny AI is an effort of the AI community to reduce the overall sizes of their algorithms especially huge computational power – this is what R stands for. It is the thing that will also accelerate inference while maintaining consistently high levels of accuracy [1] – this is the description of A, and one of the greatest things is the S from the RAS, that will improve AI by scaling down models by factor that may be as high as 10 times [1].

### **What does this mean for the future of Tiny AI?**

1. **Tiny data** or we could say a smarter way of using data. With this improvement, we could look at data reduction techniques with the help of surrogate modeling [1].
2. **Tiny Hardware.** Due to the technological advances in nanotechnology, Tiny AI could help produce new things like: new structures, new architectures and even new materials, of course with the help of 3D integrated systems [1].
3. **Tiny Algorithms.** One of the most important things could be with the help of algorithms, that could be delivered “on-chip”, which would be the help of energy-efficient processing for edge [1].
4. **Limitless Possibilities.** If we look with a futuristic and technical eye, we could see that the possibilities are limitless and they could expand even more, one of the greatest of them all is a greener future with less energy waste [1].

### **Why do we need tiny AI when there is already Artificial Intelligence?**

Training sophisticated AI takes a huge amount of energy. The carbon footprint of training a single AI is as much as 284 tons of carbon dioxide equivalent (CO<sub>2</sub>e) – five times as much as the lifetime emissions of an average car [1]. As AI adoption grows it's become clear that the technology needs to become greener. Tiny AI comes here with a solution: less energy wasted for a greener future.

#### ***Applications of tiny AI***

We might think that the business that we have today will be the same for the rest of our lives, but Tiny AI with its improvement will bring a massive impact for all companies that will have to apply it in their deals.

##### **1. *Tiny AI in healthcare department***

One of the biggest wishes in healthcare is a personalized medicine, this means gathering data and turning it into actionable insights. Here are some specters:

- ROBO-CURE is a project that uses artificial intelligence for personalized treatments with type 1 diabetes.
- Connected health solutions comfortably gather medical-grade data that's used for clinical research (e.g., neurotechnology) or continuous monitoring through wearable, implantable, ingestible or non-contact technologies.
- In genomics, improvements in data usage, algorithms and hardware lead to faster results [2].

##### **2. *Tiny AI in Industry 4.0***

This means a future in which we will see collaborative robots that will work with humans with the same tasks, and this will be possible only with the futuristic traits of tiny AI [2].

##### **3. *Tiny AI in mobility and logistics***

If you're waiting for autonomous and connected cars, Tiny AI comes in this department with a lot of help with:

- **Safety measures.** The health of the driver will be checked with the help of some sensors in the seat.
- **Control system.** With just a hand gesture we will be able to control the car panel.
- **Sensors.** They will help the system to get a complete picture of the surroundings [2].

#### ***How can you use Tiny AI to make some smart solutions?***

- extraction of quality data at the edge
- adaptive processing of multi-dimensional signals from distributed sensors
- analysis and understanding of anomalies in combined data streams
- automated decisioning in specific environments [2]

#### **TinyBert– a step for tiny AI?**

BERT was created by Google as a pre-trained language model, which helps users write. It helps users to write, it has the ability to understand the words that are written by a user and it could make even better writing suggestions, but there were some huge problems that created a flow for this. BERT consists of 340 million parameters of data, which means that it is very large and only one session of training BERT would consume a large amount of energy that equals an average American household energy waste for 50 days [1].

The solution for BERT. Researchers from the Huazhong University of Science and Technology and Huawei Noah's Ark Lab have introduced Tiny BERT, a smaller and faster version of Google's popular large-scale pre-trained language processing model BERT (Bidirectional Encoder Representations from Transformers) [3].

TinyBERT was designed based on two conceptual breakthroughs: Transformer distillation, a new method developed by the researchers; and two-stage learning framework which includes the general distillation stage and task-specific distillation stage. Here are the stages:

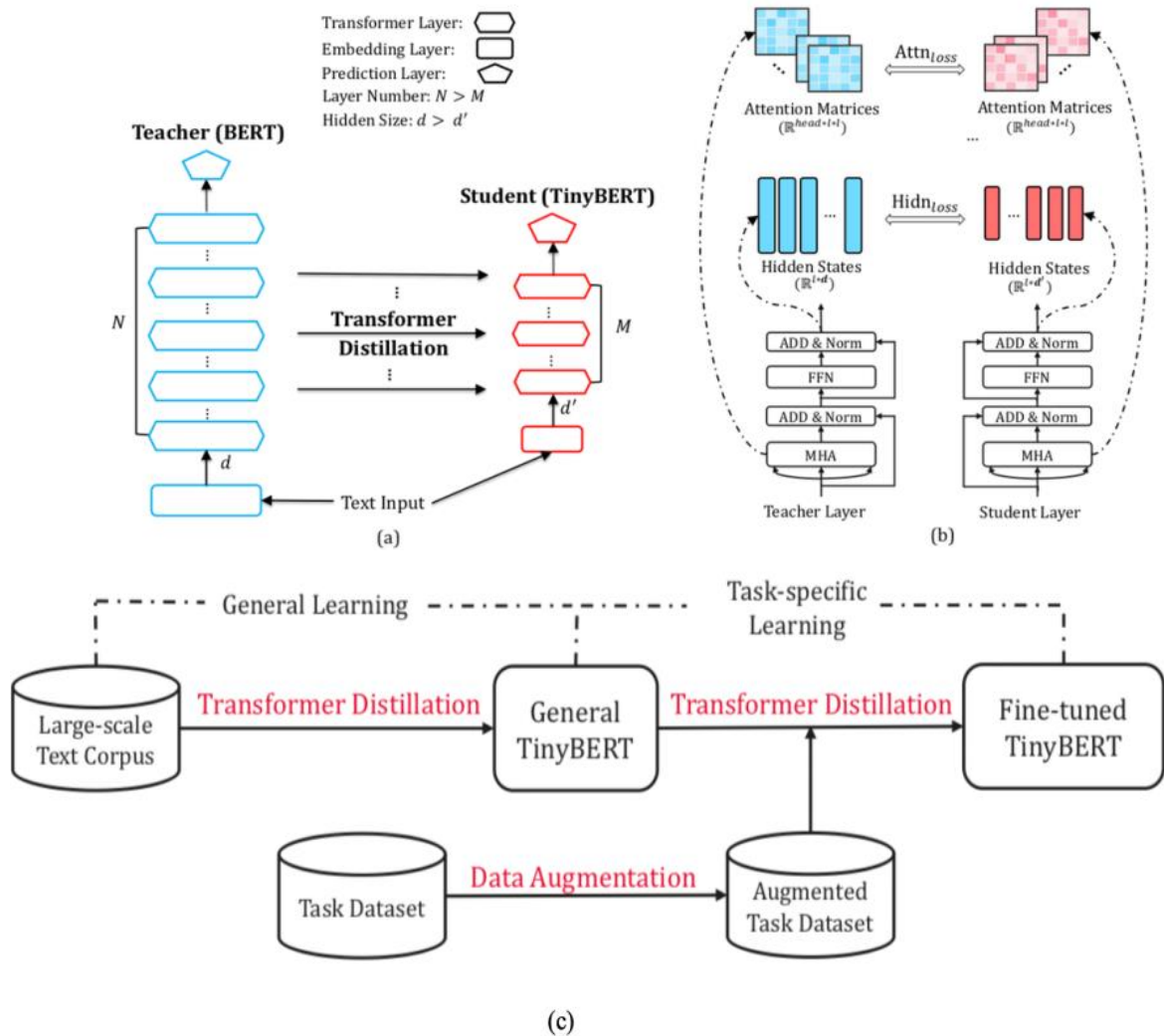


Figure 1 TinyBERT [3]

A key innovation of the two-stage learning framework is the addition of a general TinyBERT between the larger-scale text corpus and the downstream fine-tuned TinyBERT. By incorporating more task-specific data, knowledge within the general TinyBERT can be further transferred to a more task-related, fine-tuned TinyBERT [3].

In this way, Huawei reduced successfully BERT, 7.5 times and as a plus, they also improved its overall speed 9.4 times, calling it TinyBERT. The original authors claimed that TinyBERT was able to achieve as much as 96% of the original's performance [1].

### The Importance of Tiny AI

For the future we see new possibilities, new development and a new future that will be able to fit into our own pocket with the help of Tiny AI. Here are some highlights for Tiny AI:

1. It can make possible for the tech community to deploy any complex algorithm from an edge device.
2. Anyone could conduct medical image analysis using their smartphones.
3. Users will be able to improve on data security and privacy.
4. Users will not have to send over data to the cloud. Instead, these programs could easily be deployed on the device itself. [2]

### **Conclusions**

To summarize, Tiny AI is the future for AI and the idea of storing such huge data in our small devices sounds great, that will push the evolving scale of artificial intelligence in many areas and that will develop new abilities and less effort for us, people. By applying Tiny AI in the most domains of our daily tasks, the world efficiency will grow in huge ways and that means a greater evolution, lower power waste, functionality and privacy improvement and smart data storage. Seek improvement in order to make an impact today, that will influence tomorrow.

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