



# 7 Questions to Ask Your Deep Learning Vendor



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Deep learning is not only the hot topic in artificial intelligence, it is also the hot topic in new product development. It is no wonder. From drones and cars to cameras and toys, deep learning has the ability to give products autonomy, assist people with boring tasks, and make interacting with products more engaging and useful.

Because the topic is hot, dozens of companies are claiming expertise in deep learning. The real question is how do you select your deep learning partner? We use the term partner deliberately, because the choice of a deep learning vendor will lead to a multi-year relationship as new products are developed, tested, and rolled out.

To help with the selection, Neurala created this guide with questions to ask a potential partner in deep learning.



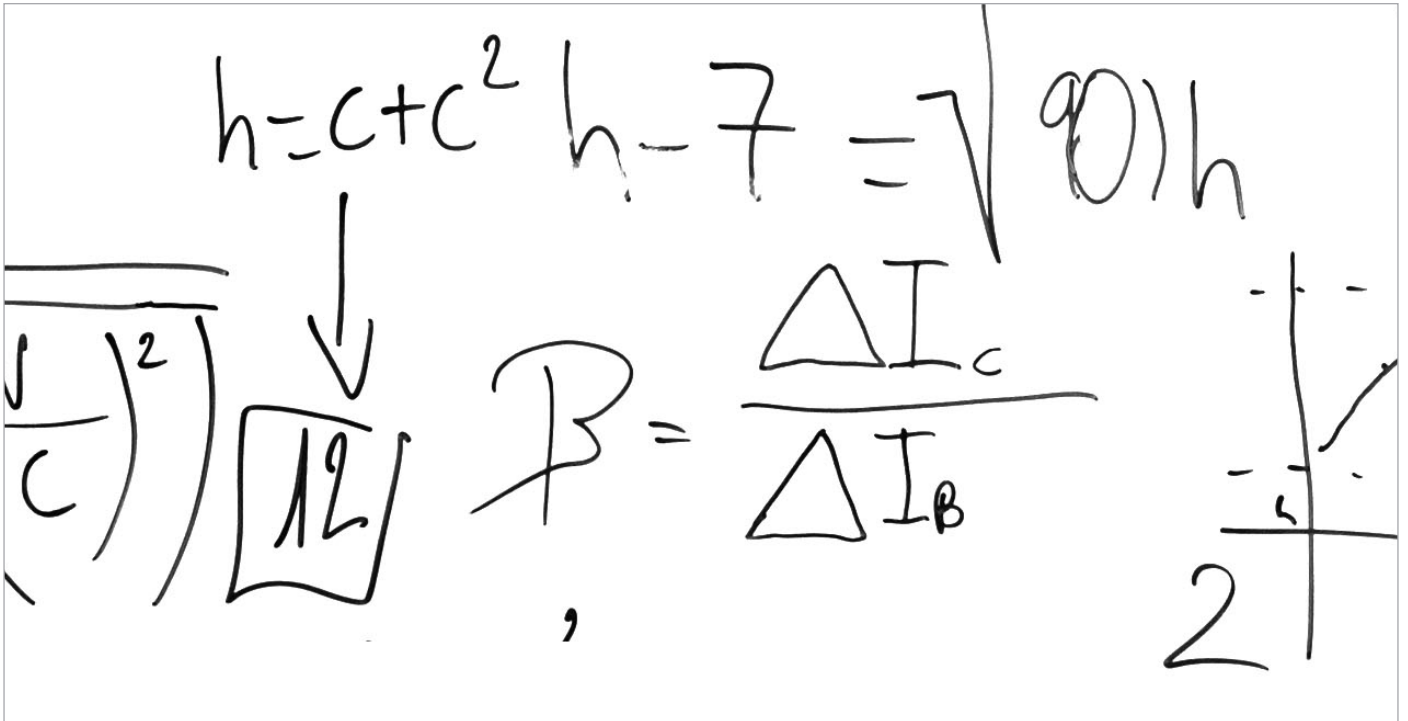
### HOW LONG HAVE YOU WORKED ON DEEP LEARNING?

Experience matters. Deep learning is a complex topic with many nuances. Some companies offer software that only works in the laboratory. Others switch from one area of machine learning or traditional data science to deep learning.

# 1

Downloading a deep learning package does not grant understanding of how these complex models work. There will be challenges. At the first challenge, and there will be many from conception to deployment, an unskilled practitioner will be stuck.

Ask your vendor how many full-time people on their team have Ph.D.'s in deep learning and whether they have published any original work on the matter. Students and part-time consultants are useful, but it is important to focus on full-time Ph.D.'s.



## WILL YOU HAVE ACCESS TO THE RESEARCH SCIENTISTS?

Your deep learning software will need to be optimized or customized for your application. The Ph.D. research scientists who understand the pros and cons of each algorithm and methodology are best suited for the challenge. Therefore, you need to have a way to access them.

# 2

Ask your vendor how much access you will have to the Ph.D. research scientists. Also, determine how you can work with them. There are three approaches that you may want to consider:

### Co-Development

Will their Ph.D. experts can work with your team and advise as they are developing products? Will they help integrate and optimize the deep learning software to accomplish specific goals?

### Customization

How willing are they to augment the functionality of their software? Be sure they are flexible when it comes to things like making a custom port to hardware or software platforms that they do not natively support.

### Proof of Concept Development

Will they provide a ready-to-use demo application or fully developed target applications? These proofs of concept can be used for internal review and for customer testing.



### DOES YOUR DEEP LEARNING SYSTEM REQUIRE ACCESS TO THE INTERNET?

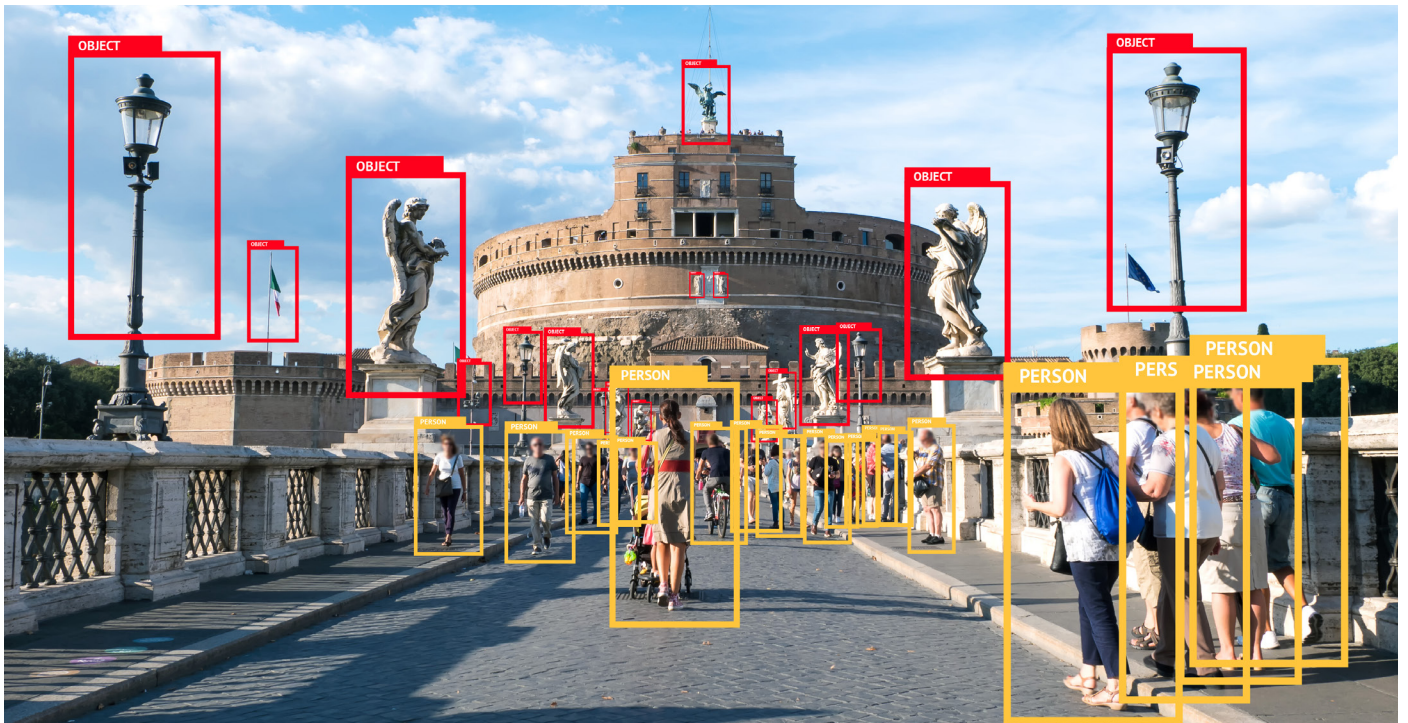
Some applications should not use Internet access for recognition. Here are examples:

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*A drone or car traveling at 60 MPH will travel almost 90 feet in one second (about the length of two busses). If it takes just one second to get a response from a server over a cellular network, a vehicle could hit a person before it gets a reply.*

*Protecting children includes keeping their images and location (e.g., IP address) off of the Internet. The U.S. Children's Online Privacy Protection Act (COPPA) and EU Privacy Directive Article 8 may mean it is illegal to learn or recognize a child, even indirectly, on a cloud server.*

Ask about the performance of their system locally or "on the edge." Determine what happens if there is no Internet access or if response time is delayed.



## HOW DIFFICULT IS IT FOR THE DEEP NEURAL NETWORK TO LEARN NEW OBJECTS?

Ask this specific question: If your neural network has been trained on 1000 objects and it needs to learn one more, does it need to be re-trained on all the objects?

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Here are some example applications where “incremental learning” matters: A self-driving car that can be personalized by each owner or dealer to a specific neighborhood. A toy that can recognize a child, without infringing on privacy. An industrial machine that can be updated in the field to recognize new items without shutting it down.

Many companies use traditional backpropagation methods that require long and costly training on servers.

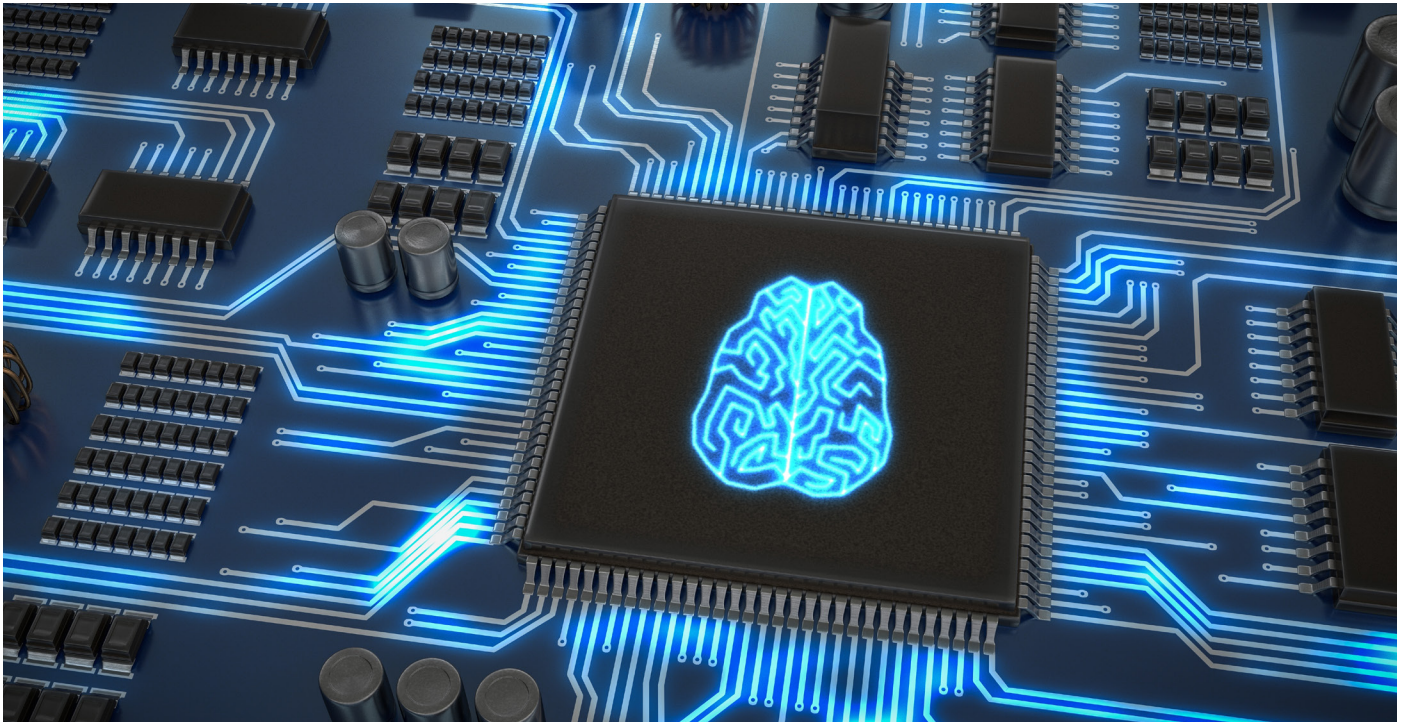


### **CAN YOUR TEAM EASILY INTEGRATE DEEP LEARNING SOFTWARE INTO YOUR PRODUCT?**

There are several deep learning tools available on the market. You will see names like Tensorflow and Caffe. Most are low level tools designed specifically for engineers trained in deep learning and data scientists who want to optimize algorithms. Many parameters are exposed, which adds to the complexity of working with the tool.

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Ask how much knowledge and experience your software developer needs to be successful with the tool. Check the documentation to see how clear and how consistent it is.



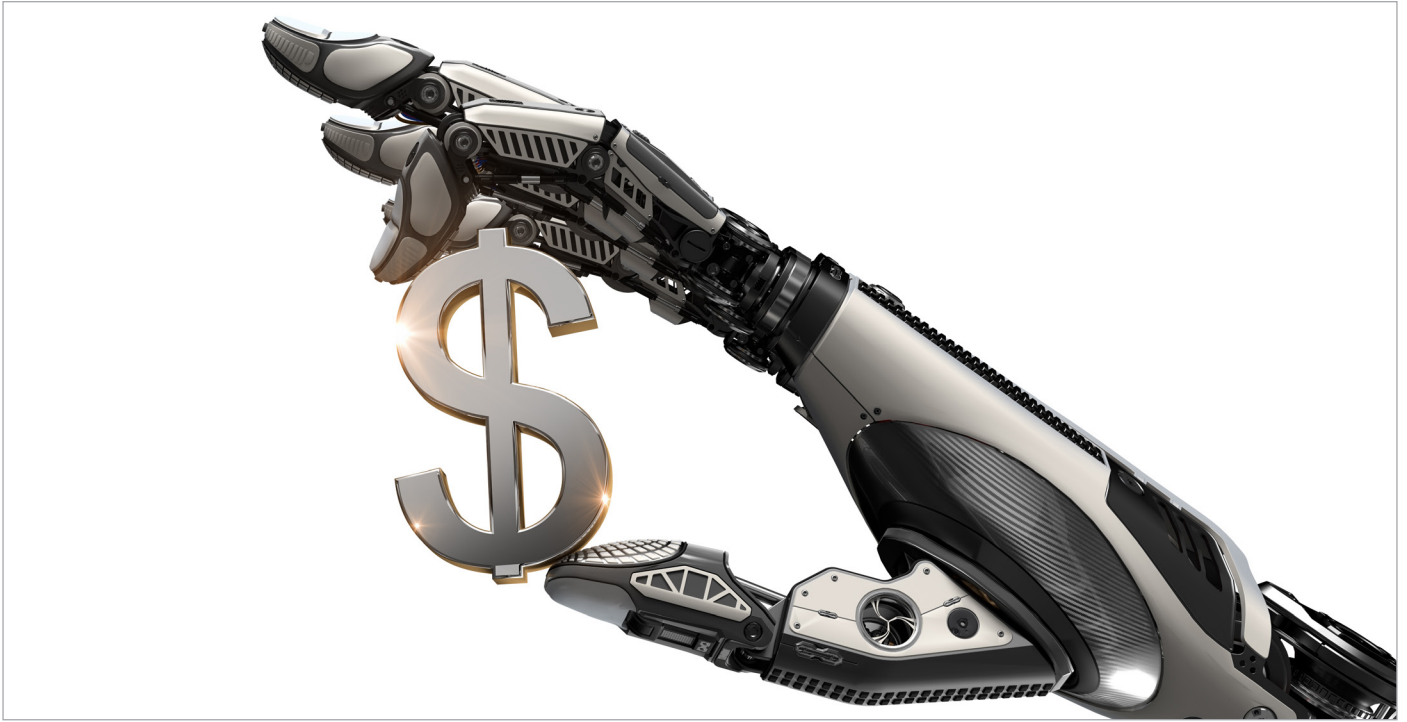
### **DOES YOUR SOFTWARE REQUIRE SPECIFIC HARDWARE?**

Consider not just your product design today but also for future and follow-on versions of your product. If you are using a hosted or web-based service, you will depend on your vendor to keep up to date. If your product requires real-time capabilities, then you need to embed software.



Ask what happens if you decide to switch to a new processor during your product run or make changes to sensors.





### HOW PREDICTABLE IS THE COST?

Ask about the pricing model. Many companies charge based on a per-API call basis or based on the number of recognitions processed. This pricing model is good for the vendor. However, it does not give you the ability to predict product costs.



Look for a simple pricing model, such as pricing per unit shipped. For server based processing, look for prices on a per image or per minute of video basis. Avoid charges per API call.



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