

## Rapidly Develop Computer Vision Models for AI-Powered Solutions with Intel® Geti™ Platform

**Intel's computer vision platform for developing AI models so that enterprise teams can teach machines to do visual tasks**

### Key Takeaways

- Data scientists, domain experts, developers, and AI professionals can all work together in the same platform, which makes applying computer vision AI to enterprise challenges fast and effective.
- Intel Geti platform works with most AI frameworks and exports trained computer vision AI that can run on the devices you already have—laptops, industrial PCs, servers, and data centers in the cloud.
- REST APIs and the software development kit (SDK) enable users to integrate the Intel Geti platform into their value chain to push data directly into the platform and pull trained models directly into their deployment pipelines.

### The Challenge: Putting AI to Work Across Industries

AI is making major strides in research labs where computing power, time, and technical expertise are a given. In the lab, data is clean, experiments are controlled, and the process can go through many iterations to reach accurate results. Unfortunately, enterprise teams rarely have the resources or the patience for experimentation. If AI is going to solve practical problems, implementing it has to be quick, reliable, and far easier to do.

### A New Solution: Intel® Geti™ Platform

Intel is working across several fronts to put AI to work in industrial and commercial applications. One of the key bottlenecks is the technical difficulty of training AI to do a new task. Training can take weeks, even months, of data science resources and immense computing power. These challenges make AI training inaccessible to the industry experts and software developers who have the knowledge data scientists need to put AI to work on practical tasks.

To break these bottlenecks, Intel has created the new Intel® Geti™ platform—a collaborative, intuitive platform that makes training AI for computer vision accessible and agile.

### AI 101: Neural Networks, Deep Learning Inference, and Retraining

There are many strategies and formats for building artificial intelligence. The Intel Geti platform works with a specific type of AI called a convolutional neural network (CNN). Neural networks are modeled on the structure of the human brain. Like the brain, CNNs learn by associating features—edges and shapes in pictures, sounds and rhythms in language—to create meaning. Unlike the brain, neural networks aren't fast learners.

### Training: How Neural Networks Learn

Neural networks learn by training on large sets of labeled data like images of animals, cars, and trees. The network reviews the data and guesses what things are. Then the network checks its predictions against the labels. Successful guesses create connections between the network's "neurons." Failed guesses create dead ends in the network.

At first, the network is empty and needs to be trained to make predictions. With each training cycle, more and more predictions work, and the network gradually becomes accurate. Reaching workable accuracy, say 95 percent, can take hundreds of training cycles and large sets of data.

Collecting, curating, and labeling data sets for training takes weeks of highly skilled data science labor. Training itself requires hours of computing power.

Sadly, because such curated datasets may not represent the current challenges, the finished neural network may or may not work well in industry applications as well.

### **Deep Learning Inference: How AI Performs Tasks**

Once a neural network reaches a useful level of accuracy, say 95 percent, it can be exported as a trained deep learning model. This exported model can be run on powerful servers or general-purpose computers—like laptops, smartphones, or smart cameras—for a process called inference to compare new data against a trained model and predict what things mean. Inference powers everyday AI like fingerprint readers, text autofills, and speech recognition.

### **Retraining: How Neural Networks Learn New Things**

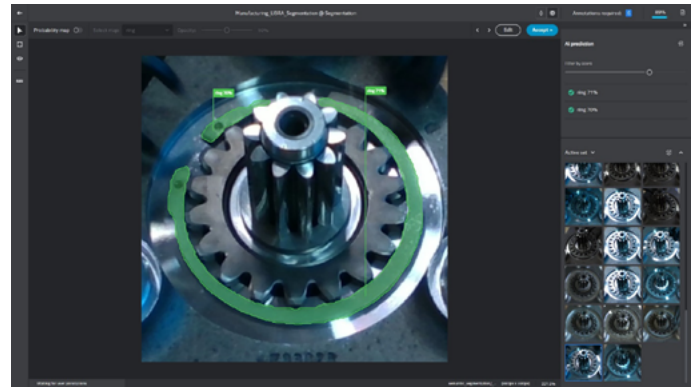
Thankfully, teams don't have to start from scratch to create a new deep learning model for a specific task. A pretrained neural network probably won't recognize cancer cells, defective welds, or a specific car model. But they can add those abilities by retraining the neural network on a new subset of labeled data.

Retraining takes less time and effort than starting from zero, but it's still a challenge. Training an AI model for a specific task requires the knowledge of domain experts plus the expertise of a data science team. Together, these two different disciplines capture and label useful training data, review training results, then test inference performance in the field. A workable solution may take multiple rounds at every stage and months of labor.

### **With the Intel Geti Platform, AI Does the Hard Work**

The Intel Geti platform uses a type of machine learning called active learning. With active learning, human experts become teachers who stay in the loop as the machine trains. Active learning makes labeling data and retraining neural network models fast and less labor intensive.

1. Upload a data set—20 to 30 images to start.
2. After the first round of training, the Intel Geti platform reviews the data and chooses the best candidates for training.
3. Continue to select what you want the platform to find and label it.
4. The Intel Geti platform begins retraining the model and making predictions.
5. Accept or correct predictions and label more data.
6. The model's accuracy improves rapidly.
7. Export inference packages with a click.
8. To retrain, upload new images, add them to the data set, and export an updated model.



**Figure 1.** The Intel Geti platform uses active learning to simplify labeling and speed up AI training<sup>1</sup>

### **Work with an Intuitive, Time-Saving Platform**

The Intel Geti platform includes the kind of time-saving capabilities you'd expect in a professional image-editing application. It has features for knocking out backgrounds, autodetecting similar objects, and segmenting shapes. The Intel Geti platform makes batch processing, image analysis, and labeling drag-and-drop simple.

### **Export Inference Packages for Practically any Hardware**

The Intel Geti platform exports production-ready deep learning models in several formats, including Google's open source TensorFlow framework and open source OpenVINO™ toolkit files for Intel® CPUs, GPUs, and VPUs. Models can be automatically optimized for OpenVINO toolkit to be deployed on virtually any laptop, desktop, embedded PC, or server containing Intel® hardware—including the machines you already have.

### **A Single Collaborative Platform for Domain Experts, Data Scientists, and Developers**

The Intel Geti platform flattens the learning curve and breaks down silos so that it's easy to build human knowledge into AI. Professionals with varied levels of AI expertise can work in the same platform where they can see the results of training immediately.

Domain experts and data scientists don't have to translate knowledge into labeled data sets and hope training delivers accurate results. Instead, domain experts can participate in the training loop and bake their knowledge into the model as it learns.

By reducing labeling and training effort and enabling collaboration across teams, the Intel Geti platform is helping turn the promise of AI into practical, productive solutions for enterprise applications.

## Intel Geti Platform Use Cases

The platform retrains convolutional neural network models for key computer vision tasks, including:

- Axis-aligned as well as rotated object detection
- Semantic as well as instance segmentation, including counting
- Single-label, multi-label, and hierarchical classification
- Anomaly classification, detection, and segmentation

It also supports task chaining, so enterprise teams can build multistep, smart applications.

### Manufacturing

Develop AI for autonomous assembly, defect detection, industrial controls, and worker safety systems.

### Smart Agriculture

Develop models for autonomous machines to analyze crop health; identify pests and weeds, then spot-fertilize and treat; and harvest crops.

### Smart Cities

Develop AI for traffic-management systems to route traffic automatically, build solutions that recognize and respond to emergencies, and use camera data to improve safety in near-real time.

### Retail

Develop AI for autonomous inventory management systems; smarter safety and loss prevention; and accurate, touchless checkout.

### Video Safety

Train task-specific models for video analytics, social distancing, PPE, and safety gear detection.

### Healthcare

Develop models to detect specific anomalies in medical images, assist in diagnostics and procedures, analyze lab results and count cultures, and speed medical research.

All these models can be deployed with OpenVINO toolkit or can be integrated into your pipeline with REST APIs and a software development kit (SDK).

## Intel Geti Platform Success Stories

These early adopters are using the Intel Geti platform to train models for complex visual tasks, invent new uses for smart computer vision, and reduce sampling bias by expanding the AI training process to more experts.

### Disease Recognition: Royal Brompton and Harefield Hospitals, London



Medical specialists are training models to review electron microscope images and transform their research.

### Agricultural AI: Small Robot Company



Small Robot Company is using the Intel Geti platform to train its robots to identify and monitor each plant in a farmer's fields for crop health, weed identification, and pest control.

### Biodiversity Research: Naturalis Biodiversity Center



Researchers are creating deep learning models for a network of cameras that detect insects, enabling them to take big steps forward in biodiversity monitoring.

### Smart Cities: Sensing Feeling



Sensing Feeling is replacing its use of off-the-shelf AI models with custom models built using the Intel Geti platform. These custom models enable the classification of pedestrians, cyclists, e-scooters, and users of other forms of micro-mobility in urban environments with the aim of improving infrastructure.

### Manufacturing Quality Control: Bravent



IT consultancy Bravent is developing an efficient, flexible AI-based computer vision solution to reduce human error in complex machinery assemblies, which can be scaled and adapted across a range of industries.

## Intel Geti Platform Technical Details

### Supported Tasks

- Object detection, classification, segmentation
- Anomaly classification
- Task chaining for building models with multiple analytical steps

### Supported Deep Learning Models

There are a range of deep learning model architectures supported in the Intel Geti platform today, and support for additional architectures will be coming in future releases. The table below summarizes those supported models and also provides references to academic literature for readers interested in developing a deeper understanding.

Computer vision task	Task types	Model architectures supported
Image classification	Single label, multi-label, hierarchical	LinearHead x (Mobilenet-V3, EfficientNet-B0)
Object detection	—	ATSS + MobileNet-V2, SSD + MobileNet-V2, YOLOX + CSPDarkNet
Instance segmentation	Counting, rotated object detection	MaskRCNN x (ResNet 50, EfficientNet-B2)
Semantic segmentation	—	Lite-HRNet
Anomaly-based tasks	Classification, detection, segmentation	STFPM, PADIM

### Supported AI Frameworks

- TensorFlow
- PyTorch

### Supported Deep Learning Formats

- Native TensorFlow
- PyTorch
- OpenVINO toolkit (Intel hardware)

### Integrations

An SDK enables you to utilize REST APIs for exporting datasets, annotations, and models directly into downstream processes. This API SDK provides functionality for (1) computer vision task creation from datasets on disk, (2) project downloading (images, videos, configuration, annotations, predictions, and models), and (3) deploying a project for local inference with OpenVINO toolkit.

### Installation Options

#### Local Server

Run on a dedicated, local machine for higher speeds and more security.

#### Cloud VM

Install on a virtual machine in the cloud, without needing to manage hardware.

### Learn More About the Intel Geti Platform

If you'd like to schedule a demo, or find out more about the Intel Geti platform, please contact us.

- [geti.intel.com](https://geti.intel.com)



### Notices & Disclaimers

<sup>1</sup> Testing completed by Bravent in August 2022. Intel Geti platform pre-production version.

Performance varies by use, configuration and other factors. Learn more on the [Performance Index site](#).

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See backup for configuration details. No product or component can be absolutely secure.

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