embedded VISION ALLIANCE

TOOLS & PROCESSORS FOR COMPUTER VISION

Selected Results from the Embedded Vision Alliance's Fall 2017 Computer Vision Developer Survey

EXECUTIVE SUMMARY

Since 2015, the Embedded Vision Alliance® has surveyed computer vision developers regarding the products they are working on and the hardware and software tools they are using in their projects.

This white paper provides selected results from our most recent survey, conducted in November 2017. We received responses from 706 computer vision developers across a wide range of industries, organizations, geographical locations and job types. We have focused our analysis on the 323 respondents whose organizations are developing end products for consumers, businesses or governments (vs. organizations that are providing services, or providing components, subsystems or software for incorporation into new products).

We hope these selected results provide insight into the popular hardware and software platforms being used today for vision-enabled end products.

Full survey results are available for Embedded Vision Alliance member companies. Please email info@embedded-vision.com for more information.

Note: Percentages add up to more than 100% in many of the charts presented in this white paper. This is because many of the questions allowed respondents to select more than one option.

CURRENTLY USING OR PLANNING TO USE COMPUTER VISION IN YOUR PRODUCTS OR SERVICES

November 2017

71%
Currently using

20%
Planning to use

5%
Not planning to use

4%
Don't know
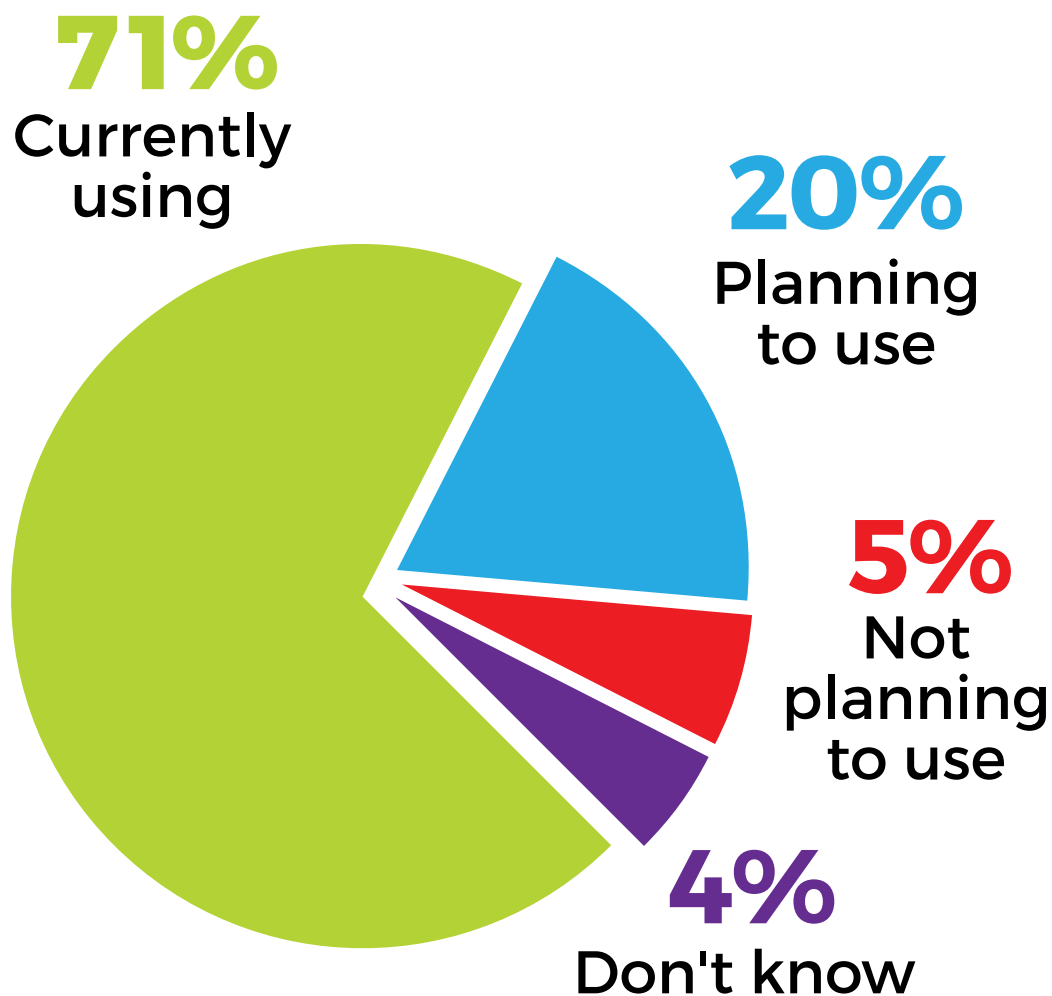
**More than 90% of survey respondents are developing or planning to develop computer vision products.** Similar to our previous surveys, the overwhelming majority of respondents are developing or planning to develop products using computer vision.

TYPES OF PROCESSORS USED FOR VISION TASKS

Ranked as One of Top Three

November 2017

Dedicated deep-learning processors are rapidly gaining in popularity. Due to their specialized architectures, they often deliver extremely high cost and energy efficiencies on deep neural network inference tasks. However, in many cases a companion processor is need to run non-neural network algorithms and other functions.

CPU	GPU	FPGA	Dedicated deep-learning processor	DSP	Vision-specific	Mobile
76%	60%	40%	32%	29%	27%	24%
+4	-5		+13	+8	-2	-13
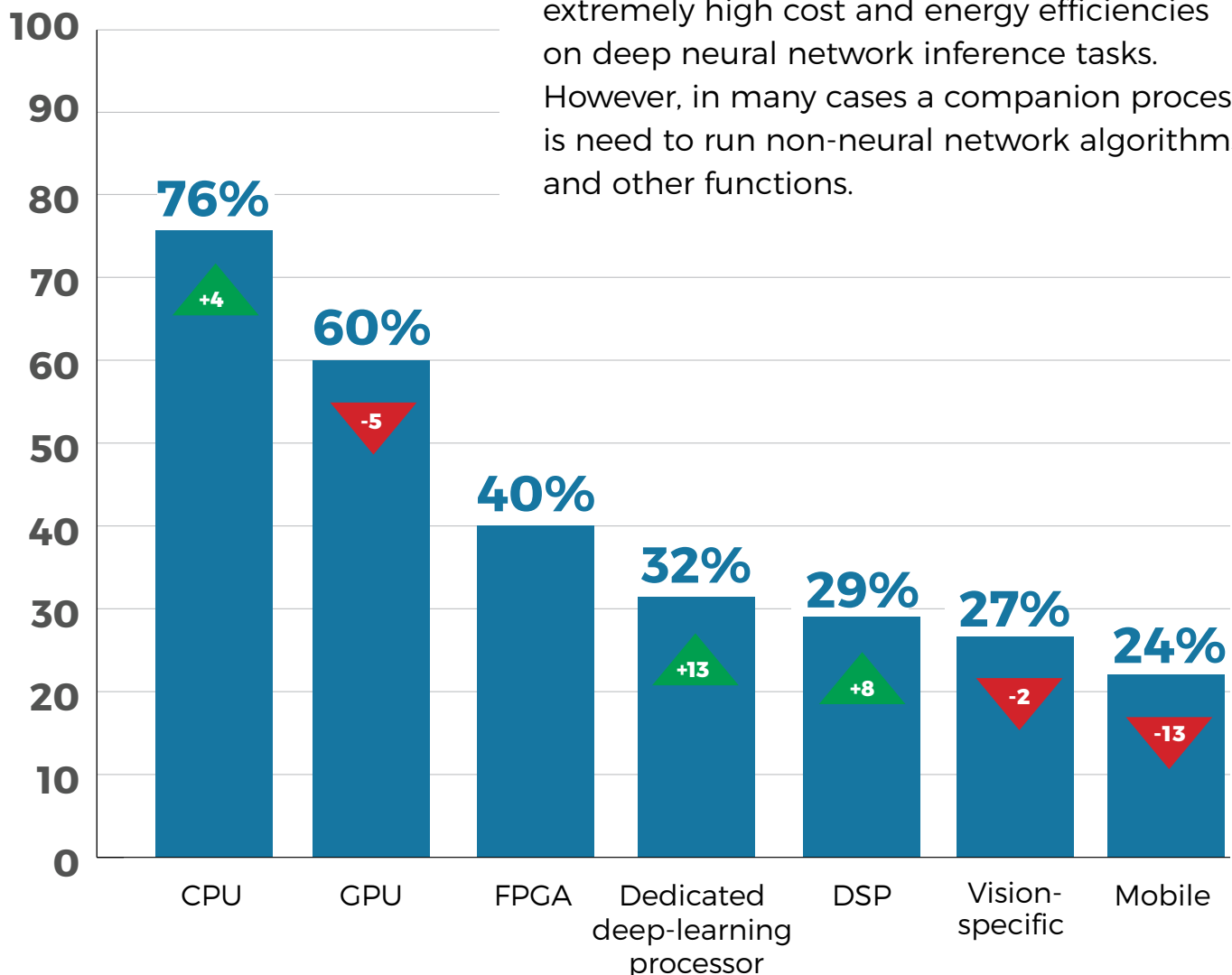
PROGRAMMING LANGUAGES USED FOR NON-NEURAL NETWORK VISION TASKS

Ranked as One of Top Three

November 2017

C++ remains the most popular language for computer vision development.
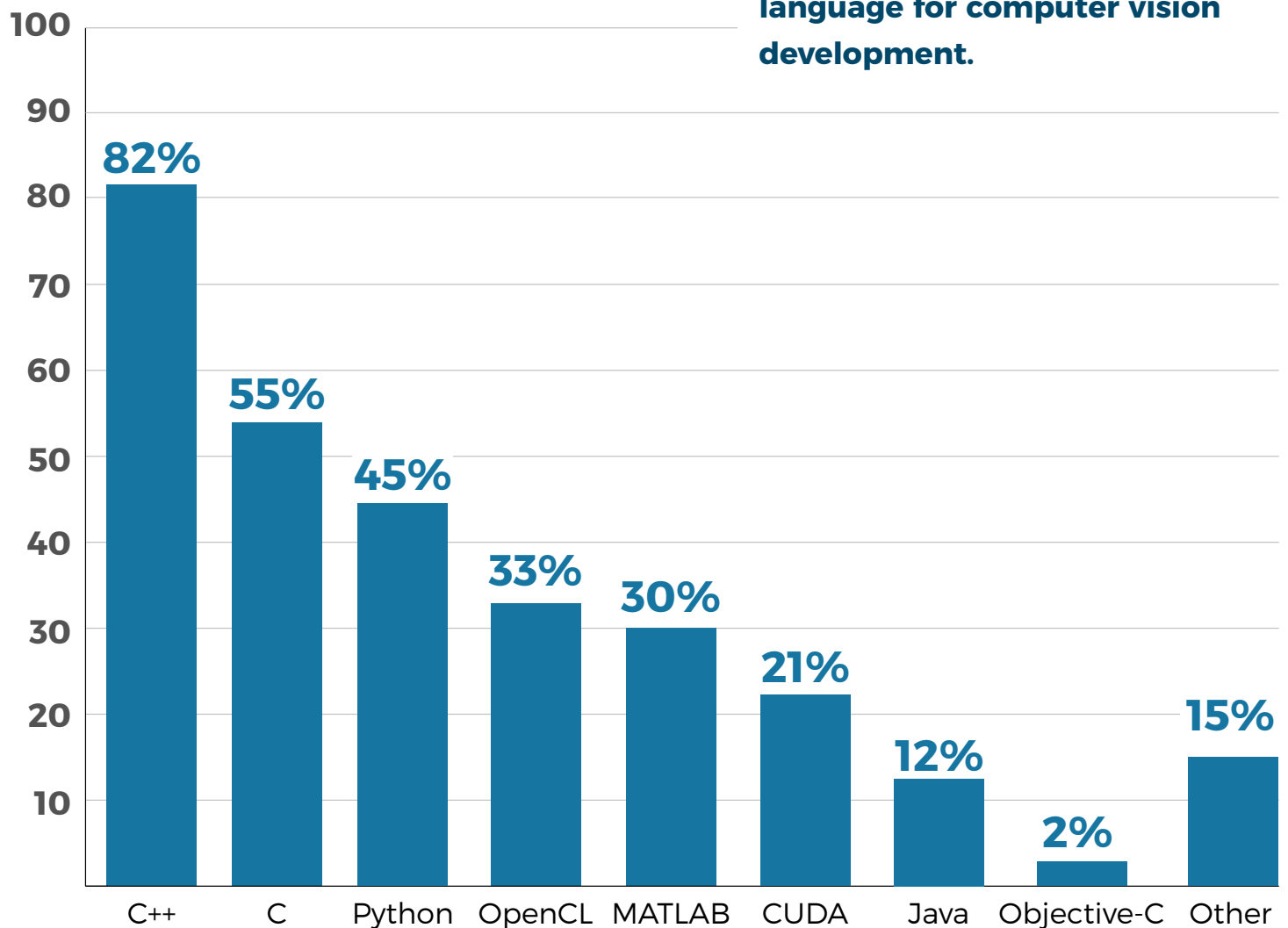
Language	Percentage
C++	82%
C	55%
Python	45%
OpenCL	33%
MATLAB	30%
CUDA	21%
Java	12%
Objective-C	2%
Other	15%

Note: This question was rephrased for the Fall 2017 Survey. The survey specifically called out non-neural network vision tasks, rather than general vision tasks as asked in previous surveys.

LIBRARIES AND APIs USED FOR IMPLEMENTING NON-NEURAL NETWORK VISION TASKS

Ranked as One of Top Three

November 2017

OpenCV dominates development. 89% of developers continue to report it as one of their top-three computer vision libraries or APIs.

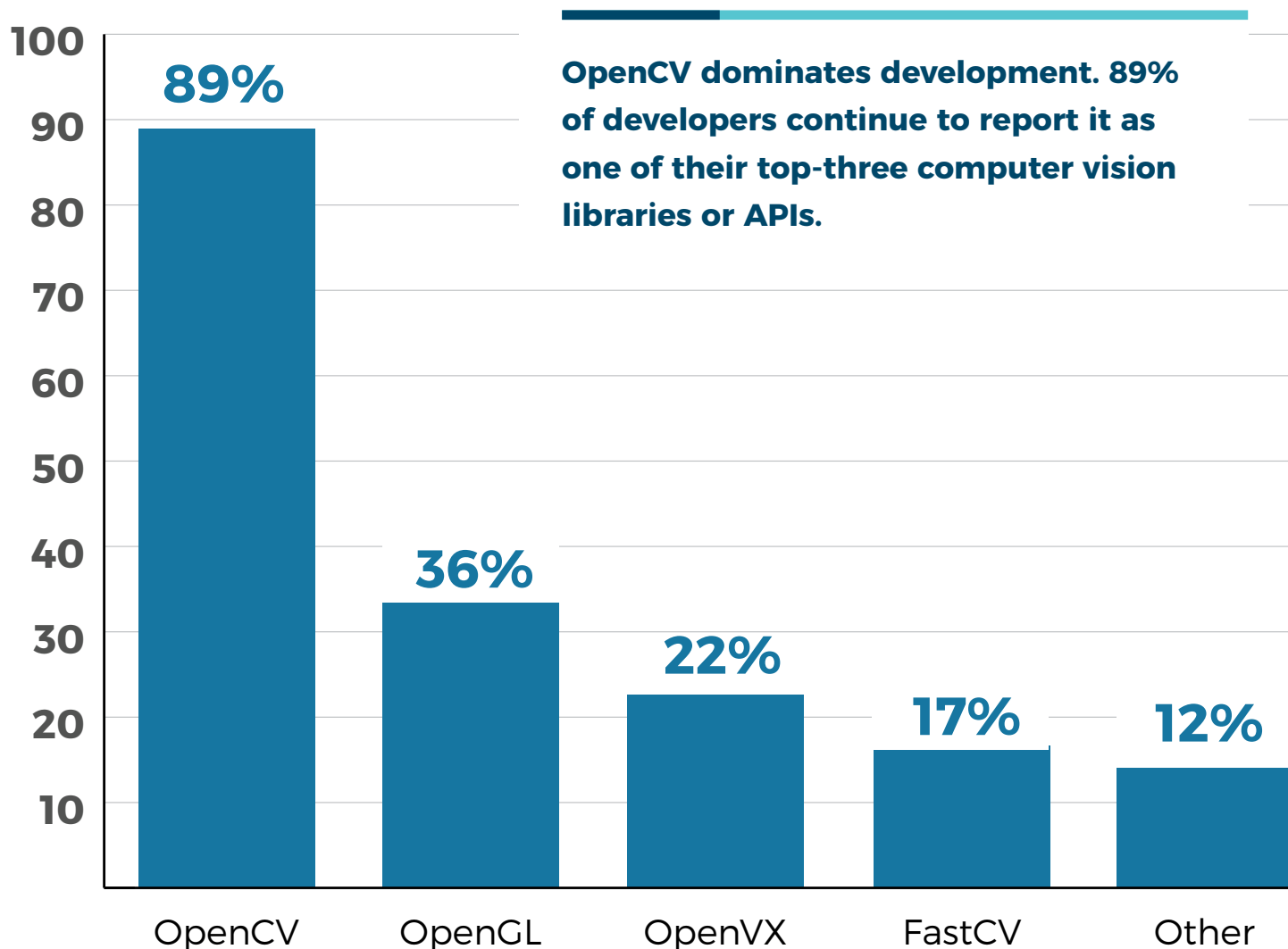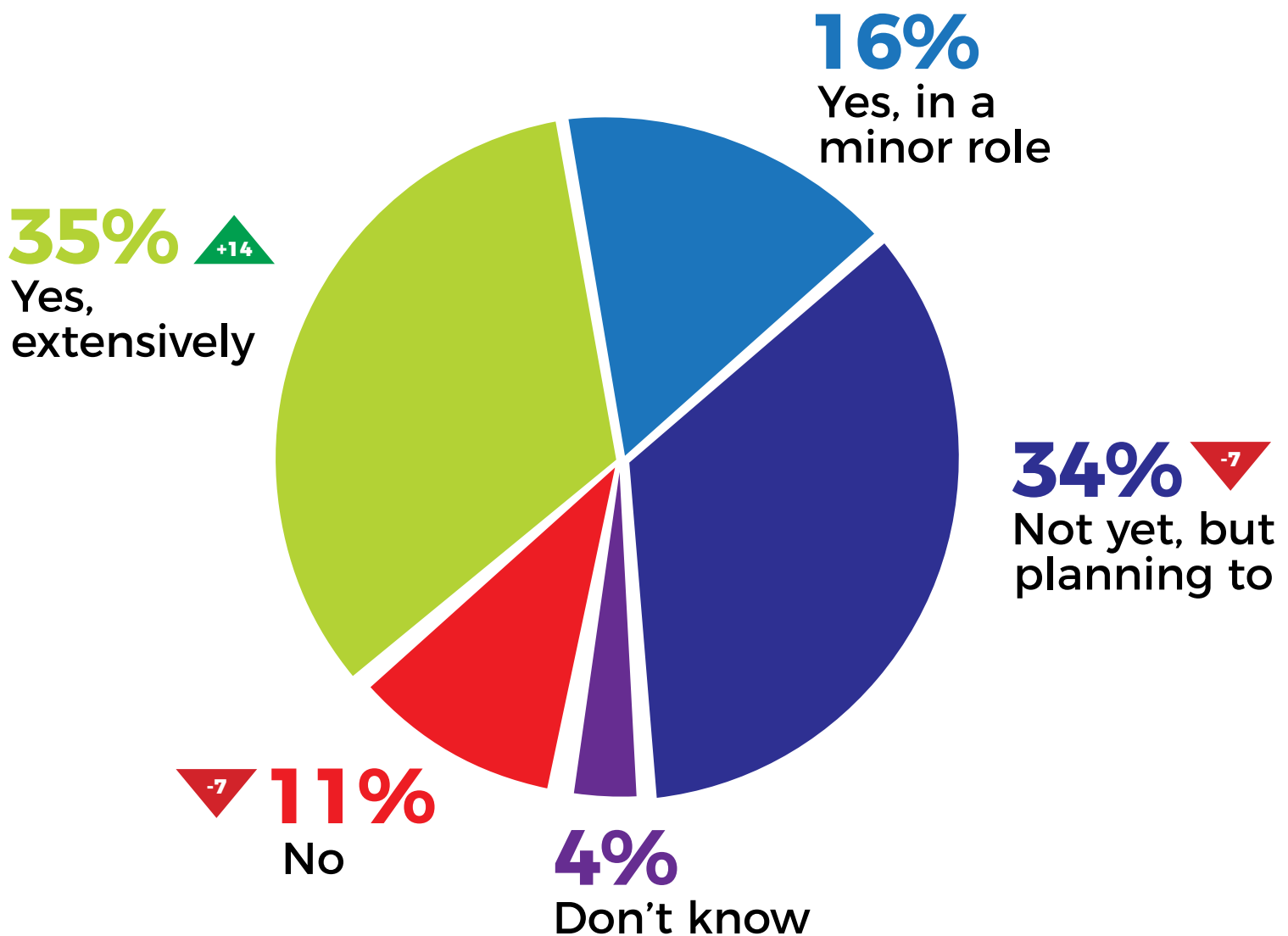| Library	Percentage
OpenCV	89%
OpenGL	36%
OpenVX	22%
FastCV	17%
Other	12%

Note: This question was rephrased for the Fall 2017 Survey. The survey specifically called out non-neural network vision tasks, rather than general vision tasks as asked in previous surveys.

USE OF NEURAL NETWORKS FOR COMPUTER VISION

November 2017

16%
Yes, in a minor role

35% ▲ +14
Yes, extensively

34% ▼ -7
Not yet, but planning to

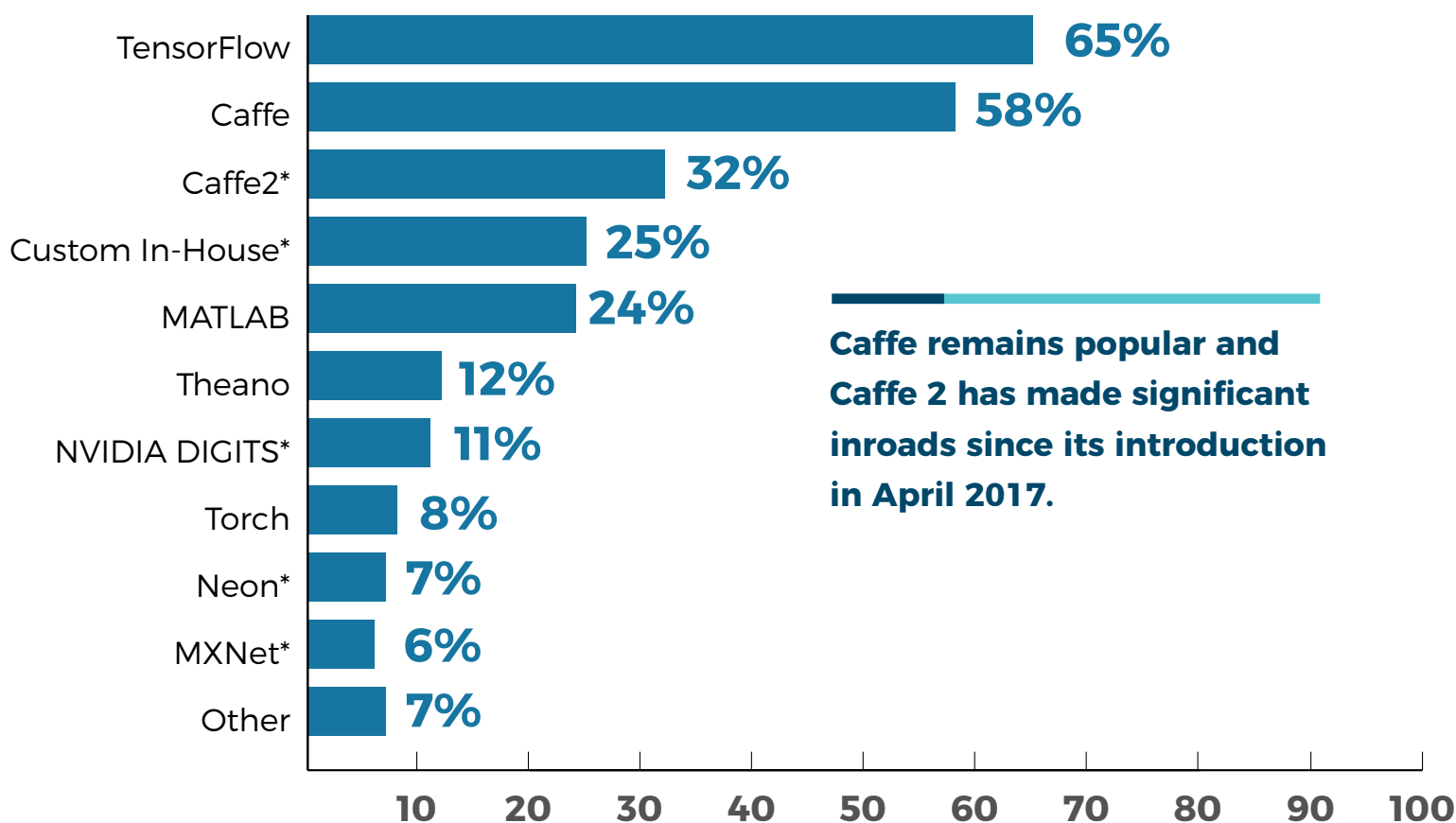▼ -7 **11%**
No

4%
Don't know

85% of survey respondents use or plan to use neural networks. In the last several years, neural networks have emerged as one of the dominant techniques for computer vision.

SOFTWARE USED FOR CREATING AND TRAINING NEURAL NETWORKS FOR VISION TASKS

Ranked as One of Top Three

November 2017

TensorFlow steals the show. Since its introduction in late 2015, Google's open-source TensorFlow has emerged as the most popular deep learning/neural network design framework, displacing all others.

Software	Percentage
TensorFlow	65%
Caffe	58%
Caffe2*	32%
Custom In-House*	25%
MATLAB	24%
Theano	12%
NVIDIA DIGITS*	11%
Torch	8%
Neon*	7%
MXNet*	6%
Other	7%

Caffe remains popular and Caffe 2 has made significant inroads since its introduction in April 2017.
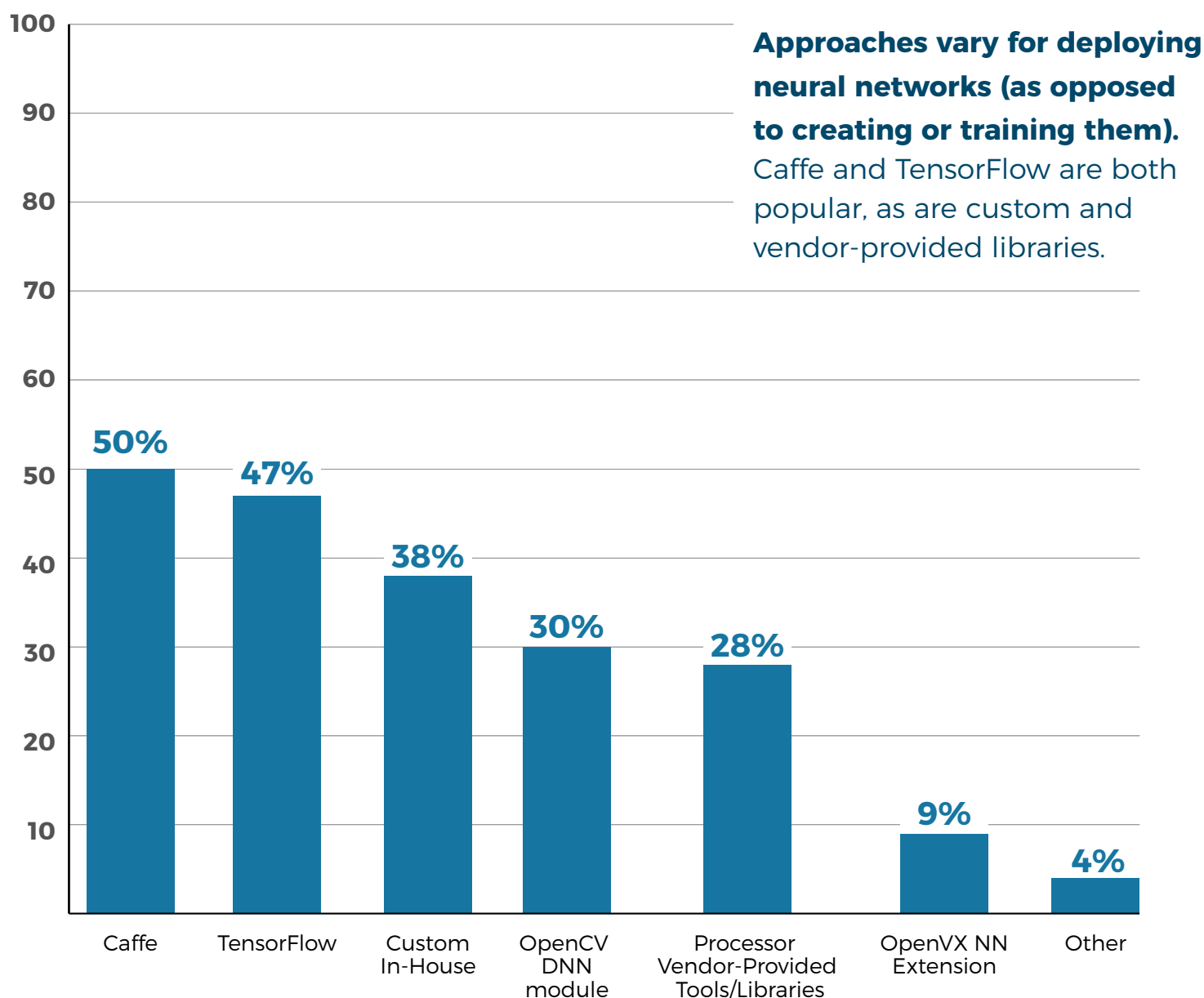
Note: For this survey, we added 5 new answer options, marked with an asterisk. This was a sufficiently large change that comparison with answers from our last survey was not meaningful for this question.

SOFTWARE FOR DEPLOYING NEURAL NETWORK INFERENCE FOR VISION TASKS

Ranked as One of Top Three

November 2017

Approaches vary for deploying neural networks (as opposed to creating or training them). Caffe and TensorFlow are both popular, as are custom and vendor-provided libraries.

Category	Percentage
Caffe	50%
TensorFlow	47%
Custom In-House	38%
OpenCV DNN module	30%
Processor Vendor-Provided Tools/Libraries	28%
OpenVX NN Extension	9%
Other	4%

Note: This is a new question for this survey.

OTHER ALLIANCE PROGRAMS

VISION ACCELERATOR PROGRAM

The **Vision Accelerator Program** helps companies quickly understand and navigate the technical and business complexity of incorporating visual perception capabilities so they can more quickly and confidently plan, develop and deliver their products. It is a service available to members of the Embedded Vision Alliance who are developing end products and systems with visual perception capabilities (e.g., deep learning, 3D sensing).

The Vision Accelerator Program helps companies:

✓ Make decisions in a fast-changing market where areas like deep learning and 3D sensing are rapidly moving from research into practical use

✓ Understand the tradeoffs for low-power, low-cost devices and cloud processing

✓ Know what vision software standards, open source tools and algorithms are gaining traction

✓ Identify which startups, suppliers, partners and experts have relevant vision technologies and know-how

✓ Build skills and recruit the right talent

✓ Access and develop a network of experts, suppliers and partners

For more information on the Vision Accelerator Program, email **accelerate@embedded-vision.com**

EMBEDDED VISION SUMMIT

The **Embedded Vision Summit**, held in Silicon Valley every year in May, is the only event focused exclusively on the technologies, hardware and software that bring visual intelligence to products. The Summit presents the latest practical techniques and technologies for vision-based product development, and illuminates the commercial landscape, trends and business opportunities in this fast-growing market.

The Summit inspires participants to use vision technology in new ways and empowers them with the know-how they need to integrate vision capabilities into products.

The 2018 event will feature more than 90 expert presenters in 4 conference tracks covering every aspect of computer vision. The event's Vision Technology Showcase includes more than 100 demonstrations of commercially-available computer vision components and solutions—both in hardware and software—from more than 50 top suppliers. Day 3 of the conference consists of in-depth Vision Technology Workshops presented by Alliance Member companies.

For more information on the Embedded Vision Summit, please visit **www.embedded-vision.com/summit**

embedded VISION ALLIANCE

1646 North California Blvd | Suite 220

Walnut Creek, CA   94596   USA

Phone: +1 (925) 954-1411

Fax: +1 (925) 954-1423

info@embedded-vision.com