TossingBot can grab objects and toss them in specified bins

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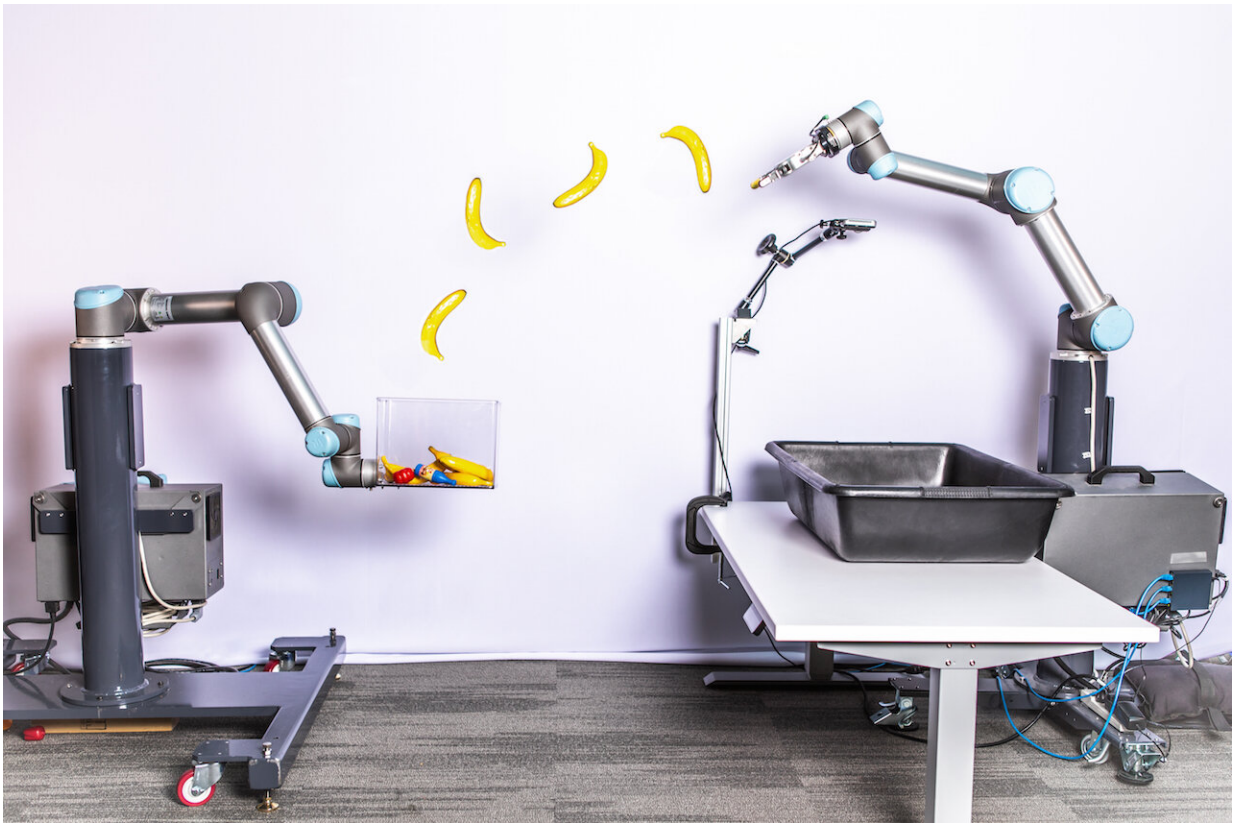

The TossingBot. Credit: Google

A group at Google with assistance from teams at Columbia and Princeton Universities and MIT has developed a robot that is able to grab a single object from among other objects in a box and toss it into a

specified bin. In their paper uploaded to the *arXiv* preprint server, the team describes the challenges of the work and how well it turned out.

The researchers start by pointing out just how hard it is to grab a random object and throw it with any precision. The randomness of the object chosen means that the thrower must make critical decisions before tossing, taking into account the weight and shape of the object. The thrower must then be able to convert the decisions into an action that will send the object in an arc from the tosser to the target. In this new effort, the team chose to take up the challenge of building a robot arm that does it as well as a human being.

The robot designed by the team looks very simple—it is a robot arm, much like those that build cars in factories. In action, the robot bends its arm down into a box full of objects, selects one, then tosses it into a box that has been divided into separate bins—hitting the bin it has chosen as the target.

To build the robot, the team had to help it learn, first by programming it to scan and make some sense of the objects it needed to toss. After that, it had to learn how to choose an object randomly and pick it up. Next, it had to use a deep-learning network to learn how to toss each possible object and then to use what it had learned to toss the object, learning more with each repetition.

Once the system was in place, the researchers programmed a loop and let the robot toss its objects into boxes 10,000 times without assistance. The programmers added some code to allow the robot to empty the bin box back into its own box when it had tossed all of its objects.

The researchers report that testing showed the system to be approximately 87 percent accurate in grabbing an object to toss and 85 percent accurate in throwing it. As a comparison, the team tried tossing

the objects themselves and found they were less accurate than their robot.

More information: TossingBot: Learning to Throw Arbitrary Objects with Residual Physics, arXiv:1903.11239 [cs.RO] arxiv.org/abs/1903.11239

Project site: tossingbot.cs.princeton.edu/