How PepsiCo makes the perfect Cheetos with the help of Autonomous Systems

PepsiCo is a leading food and beverage manufacturer, and Cheetos are one of their most famous snacks. But how can PepsiCo ensure they manufacture the perfect Cheetos every time, even as the production environment changes?

Neal analytics worked with the Microsoft AI engineering team and the Cheetos manufacturing experts to build, train, and deploy an autonomous system leveraging the Microsoft Project Bonsai Platform. This solution helps PepsiCo ensure the perfect Cheetos snack comes out each time.

CHALLENGES

Optimizing production yield while ensuring quality is always a complex challenge. It is no different when it comes to manufacturing an irresistible snack like the Cheetos.

From ingredient characteristics to equipment behavior, it is difficult for operators and automated control systems alike to ensure consistent quality. Each batch of flour is slightly different from the previous one. Factory ambient humidity varies with days and seasons.

Although they are the same make and model, extruders across manufacturing lines will have minor differences within their manufacturer's tolerance range.

Finally, like any mechanical equipment, extruders wear over time which also impacts their operating specifications.

Furthermore, once baked, quality assurance often needs to sample Cheetos for quality control. This, in turn, can impact production throughput. To help with these aspects, PepsiCo was looking for a solution that would both ensure consistent quality and optimize product yield.
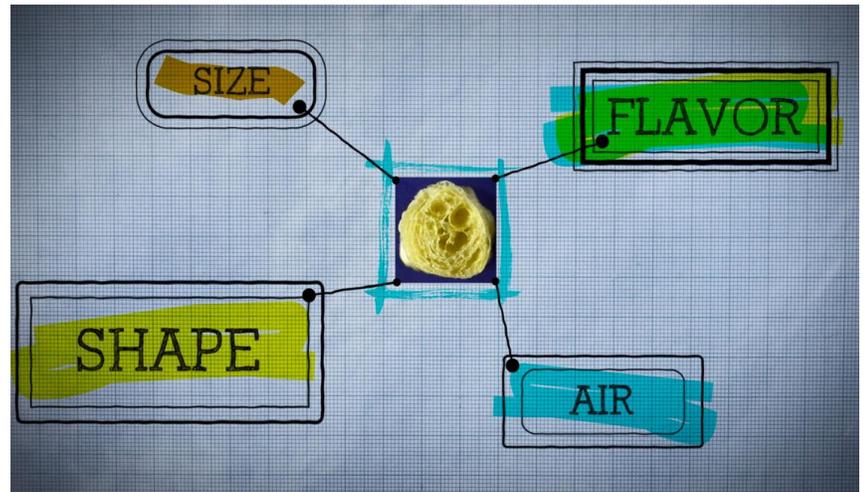
SOLUTIONS

To optimize the production yield, Neal Analytics worked closely with PepsiCo's manufacturing team, from process experts to operators, and the Microsoft AI engineering team to design, train and deploy a Project Bonsai AI agent, aka a "brain." This agent helps operators optimize the yield of the Cheetos extrusion and baking processes.
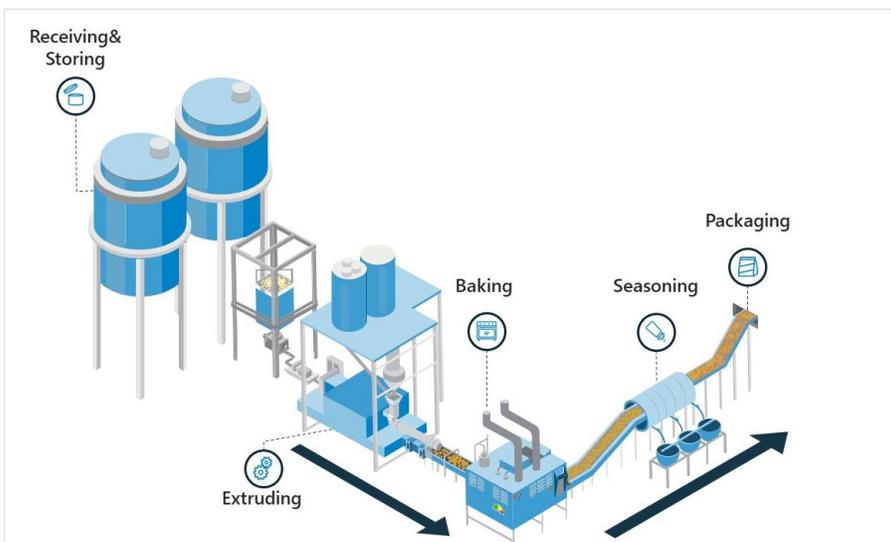

The first step to training the AI agent using the trial-and-error approach of Deep Reinforcement Learning (DRL) was to develop an accurate process simulator.

Because of the process complexity, including the fact that one of the key AI agent inputs was the Cheetos' shape, Neal Analytics AI experts developed an AI simulator using a Deep Neural Network architecture. This custom-built process simulator was itself trained using real-life process data recorded during regular Cheetos production runs.

Using this simulator and PepsiCo's process experts and operators, the DRL's so-called "reward function" was defined using the concepts of Machine Teaching and after a series of tests to optimize the solution's appropriate components from process inputs and outputs to reward function parameters.

Training vs. production
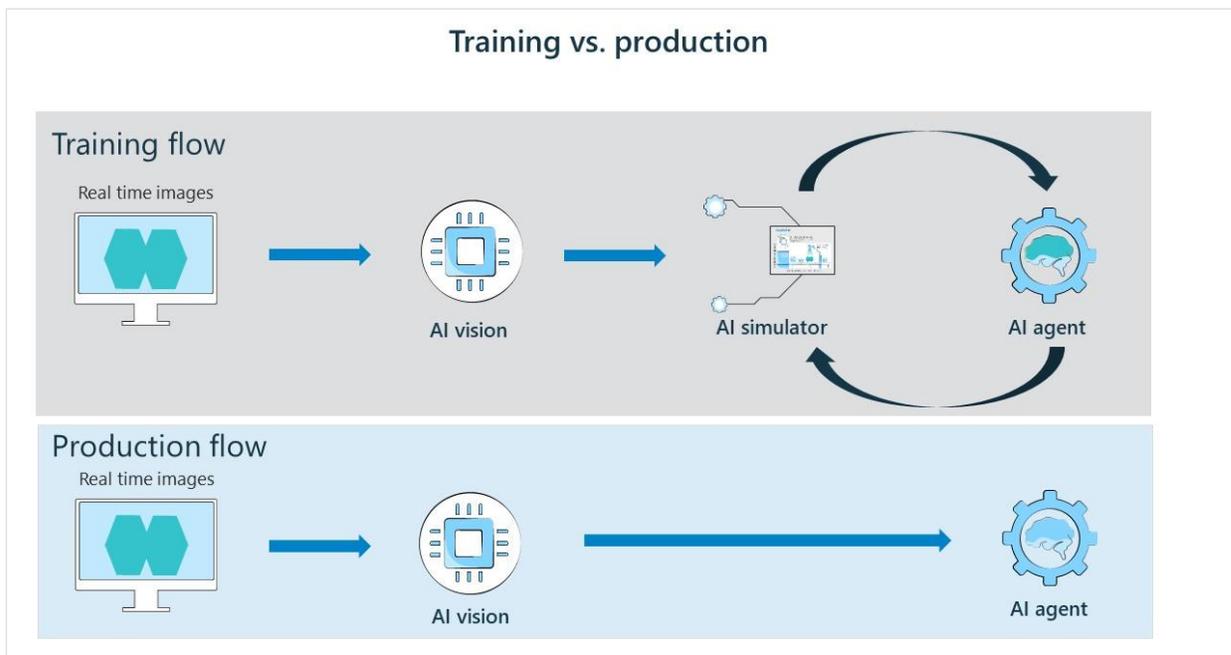
RESULTS
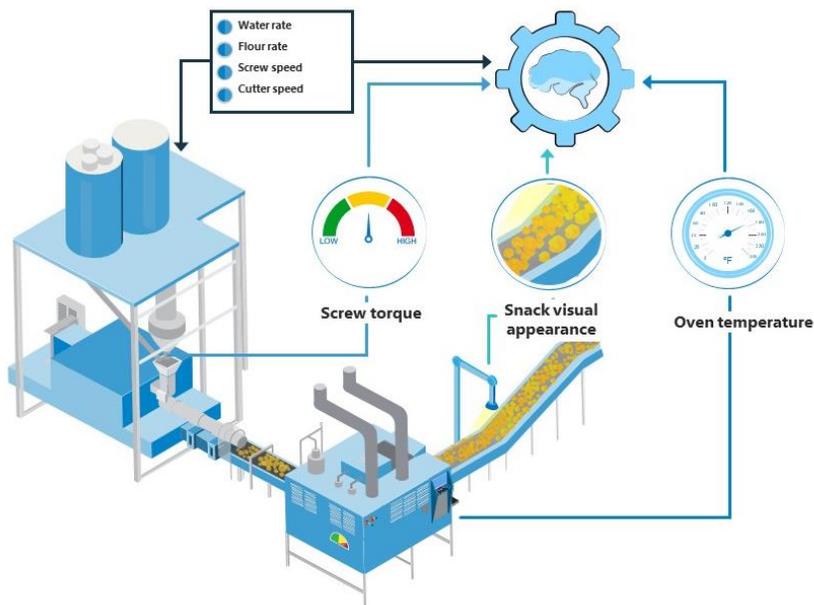
Once deployed, the AI agent offers real-time advice to the operators. This advice helps them tune the system to maximize production throughput (lbs. per hour)

As the output quality is now measured permanently using a vision AI model (also used to train the simulator) developed by PepsiCo's engineers, it now enables quality assurance testing as often as once per second without interrupting or even disturbing production.

Also, the solution simplified the management of both extruder errors and consistency issues.

Altogether, this solution improved the overall system performance by optimizing it for both throughput and quality.

Learn more:
- Video testimonial: https://go.nealanalytics.com/bonsai-video
- Microsoft AI customer story: https://customers.microsoft.com/en-us/story/858753-PepsiCheetos
- Project deployment steps video: https://go.nealanalytics.com/as-video-customer