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# Agenda

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Adapting to the changing world

Introduction to reinforcement learning and contextual bandits

Personalizer overview

Apprentice mode

Making contextual bandits work in practice

Q&A

# Azure Personalizer - Overview

Improve experience with real-time learning



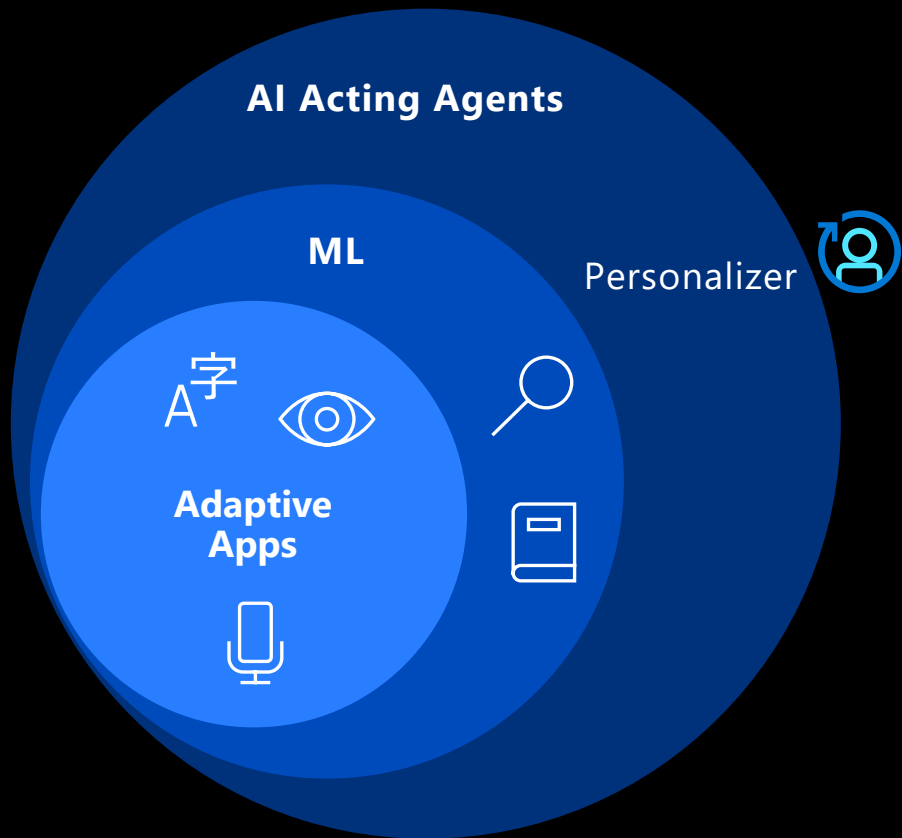
ACM  
Industry  
Award



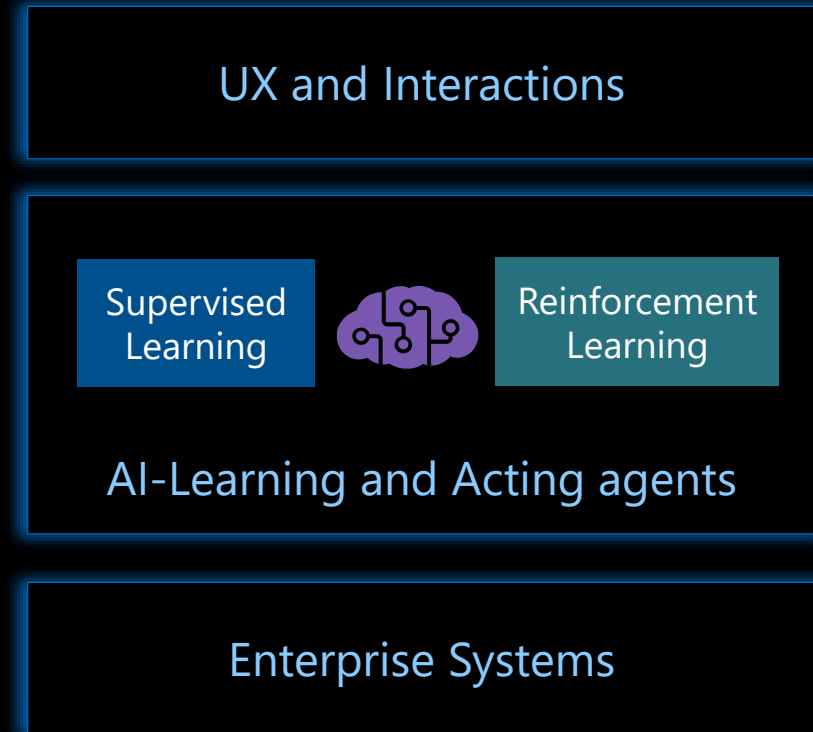
Most  
Innovative  
Product

Justin Li  
Software Engineer @ Microsoft

# How can apps react to a changing world?




Perception and prediction → reasoning and planning











# Personalizer

## [aka.ms/personalizer](https://aka.ms/personalizer)



Microsoft Azure


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## Personalizer

An award-winning AI service that delivers a personalized, relevant experience for every user

Start free 

Already using Azure? [Try this service for free now](#) 

[Product overview](#) [Features](#) [Security](#) [Pricing](#) [Documentation](#) [FAQs](#)

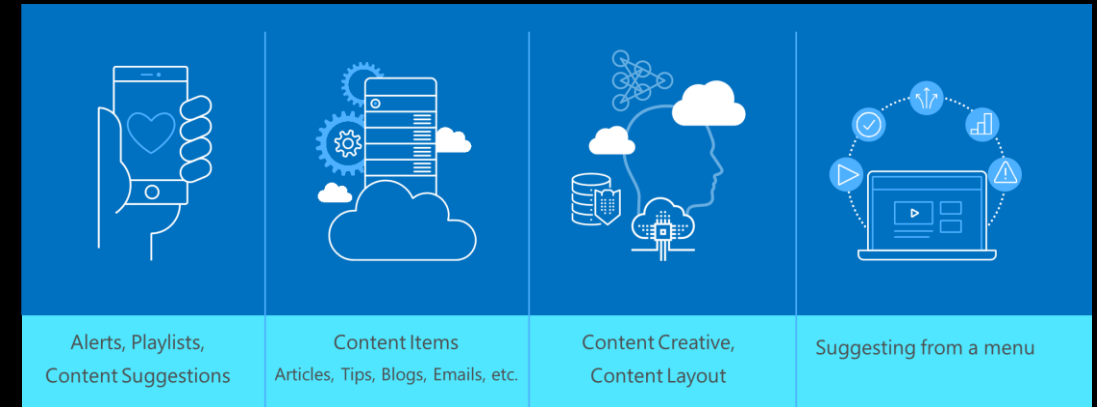
### Create rich, tailored interactions

Boost usability and user satisfaction with reinforcement learning-based capabilities only available through Azure. Prioritize relevant content, layouts, and conversations through an easy-to-use API. Use Personalizer as a standalone personalization solution or to complement an existing solution—with no machine learning expertise required.

# What is Personalizer?

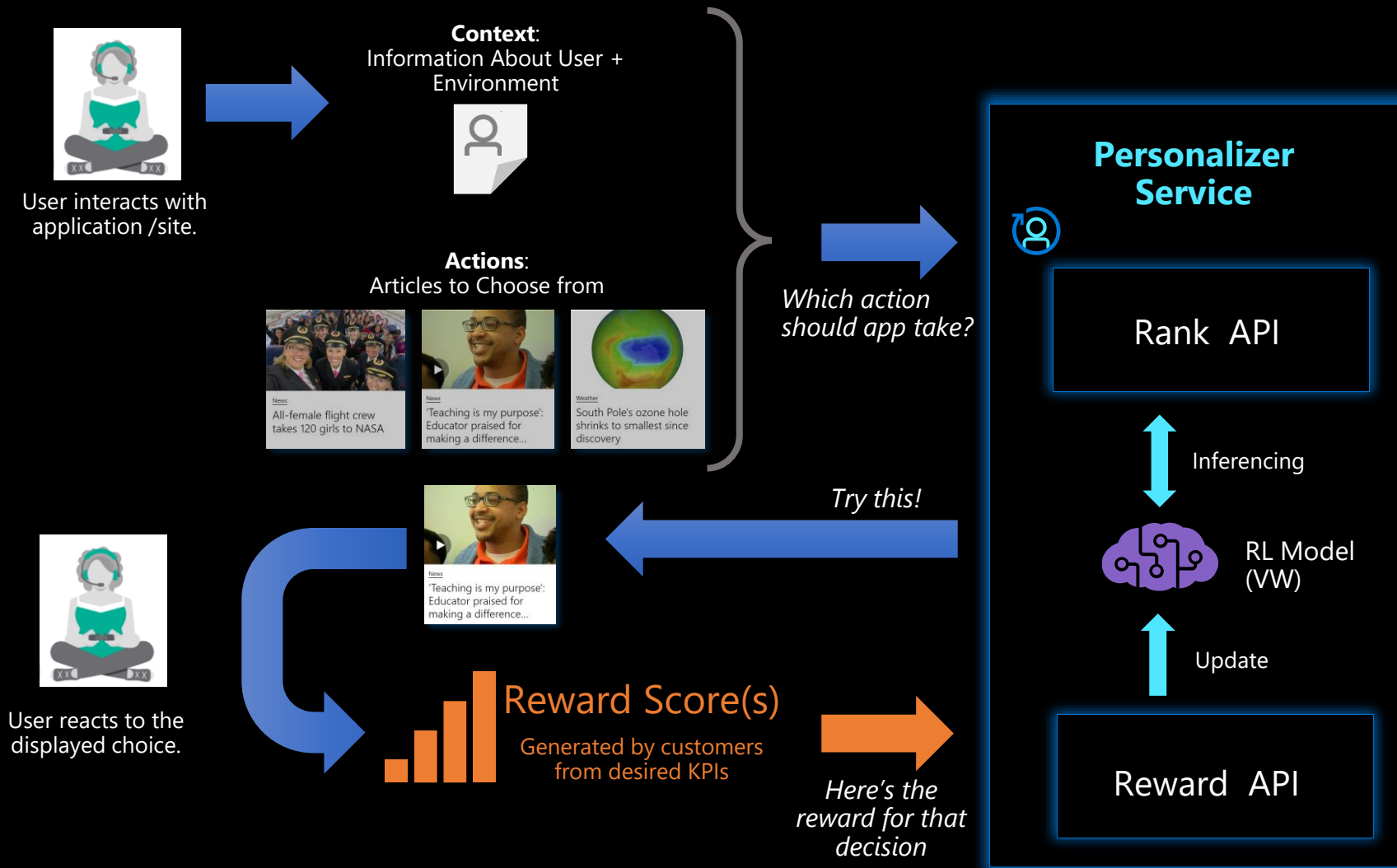
- Chooses the **best option** to show each user
- Provides **relevant experiences** that improve over time
- Stay up to date with **latest trend**
- Powered by **Reinforcement Learning**

You can Personalize almost anything



# Learn & Discover Business Rules using RL

RL-based Personalization with 2 API calls



# Start Using Personalizer - Creation

[Home](#) > [New](#) > [Personalizer](#) >

## Create

Personalizer

Name \*

Subscription \* ⓘ

Location \*

Pricing tier ([View full pricing details](#)) \*

Resource group \* ⓘ

[Create new](#)

[Create](#) [Automation options](#)

# Start Using Personalizer – Quick Start

Home > **Personalizer-AINextCon | Keys and Endpoint** Cognitive Services

Search (Ctrl+/) << Regenerate Key1 Regenerate Key2

Overview  
Activity log  
Access control (IAM)  
Tags  
Diagnose and solve problems

RESOURCE MANAGEMENT

Quick start  
Configuration  
Model and learning settings  
Evaluations  
**Keys and Endpoint**  
Pricing tier  
Networking  
Identity  
Billing By Subscription  
Properties  
Locks  
Export template

Monitoring

Alerts  
Metrics  
Diagnostic settings  
Logs

These keys are used to access your Cognitive Service API. Do not share your keys. Store them securely– for example, using Azure Key Vault. We also recommend regenerating these keys regularly. Only one key is necessary to make an API call. When regenerating the first key, you can use the second key for continued access to the service.

Show Keys

KEY 1  
.....

KEY 2  
.....

ENDPOINT  
https://personalizer-ainextcon.cognitiveservices.azure.com/

LOCATION ⓘ  
westus2



# Rank

POST <https://<endpoint>/personalizer/v1.0/rank>

```
{
  "contextFeatures": [
    {
      "timeOfDay": "Morning",
      "weather": "Rainy"
    }
  ],
  "actions": [
    {
      "id": "NewsArticle1",
      "features": [ { "type": "Entertainment" } ]
    },
    {
      "id": "NewsArticle2",
      "features": [ { "type": "Sports" } ]
    }
  ]
}
```

```
{
  "ranking": [
    {
      "id": "NewsArticle2",
      "probability": 0.8
    },
    {
      "id": "NewsArticle1",
      "probability": 0.2
    }
  ],
  "eventId": "75269AD0-BFEE-4598-8196-C57383D38E10",
  "rewardActionId": "NewsArticle2"
}
```

# Reward


## POST




<https://<endpoint>/personalizer/v1.0/events/<id>/reward>









```
{  
  "value": 1  
}
```



- Value should be between 0 and 1
- Based on business logic




# Demo – Coffee Recommendation



 Azure-Samples / cognitive-services-personalizer-samples






 Watch 35  Star 26  Fork 43

 Code  Issues  Pull requests 3  Actions  Projects  Wiki  Security  Insights

 master [cognitive-services-personalizer-samples / samples / azurenotebook / Personalizer.ipynb](#) [Go to file](#) 

 **orenmichaely** Changed instructions on how to reach personalizer configurations   Latest commit 433f9b1 on Jun 18 [History](#)

2 contributors  

934 lines (934 sloc) | 33.7 KB   Raw Blame   

## Cognitive Services Personalizer

<https://github.com/Azure-Samples/cognitive-services-personalizer-samples>

This tutorial simulates a Personalizer loop *system* which suggests which type of coffee a customer should order. The users and their preferences are stored in a [user dataset](#). Information about the coffee is also available in a [coffee dataset](#).

A summary of the user information is:

Customers	Times of Day	Types of weather
Alice	Morning	Sunny
Bob	Afternoon	Rainy
Cathy	Evening	Snowy
Dave		

To help Personalizer make the correct coffee selection for each person, the *system* also knows details about the coffee.

Types of temperature	Places of origin	Types of roast	Organic
Hot	Kenya	Dark	Organic
Cold	Brazil	Light	Not organic
	Ethiopia		

The **purpose** of the Personalizer loop is to find the best match between the users and the coffee as much of the time as possible.

The code for this tutorial is available in the [Personalizer Samples GitHub repository](#).

# Tuning Personalizer – Offline Evaluation

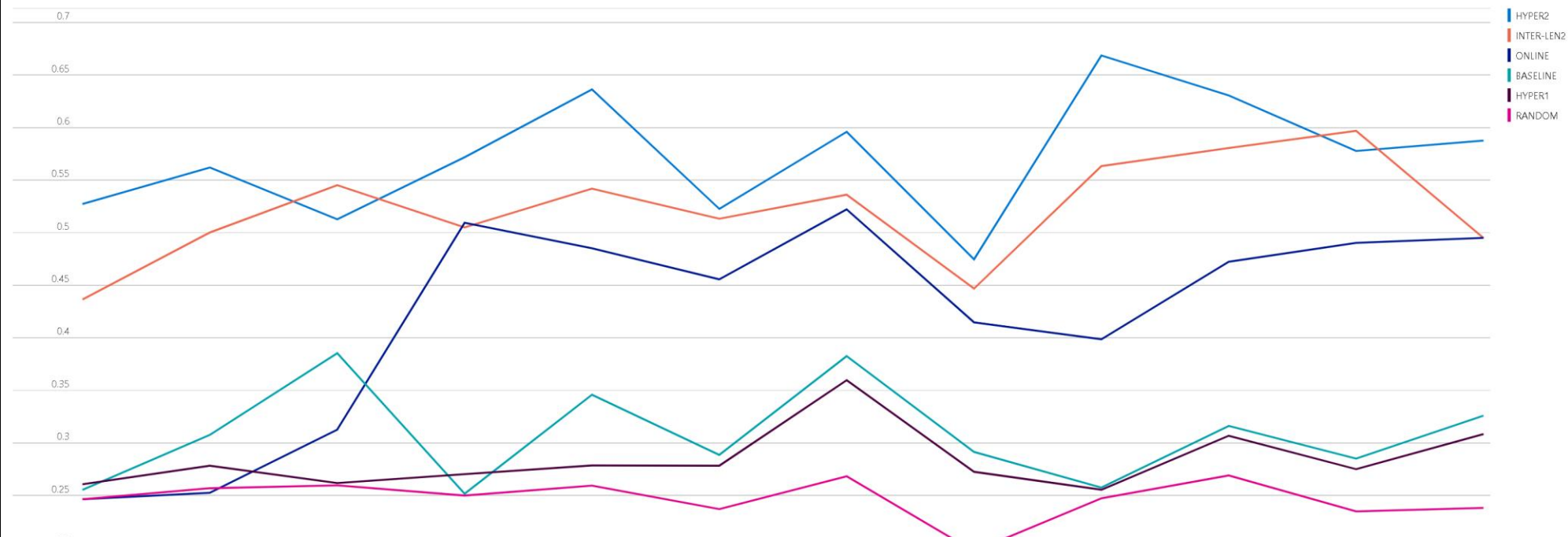
[Home](#) > [test-sample](#) | [Evaluations](#) > [Evaluation summary](#) >

## Evaluation results



Learning settings	Source	Average reward	Confidence interval (p95)	Download	Apply
Hyper2	Uploaded	0.57324	0.53968 - 0.60680	<a href="#">Download</a>	<a href="#">Apply</a>
Inter-len2	Uploaded	0.52537	0.49817 - 0.55257	<a href="#">Download</a>	<a href="#">Apply</a>
Online	Current learning settings of this Personalizer loop	0.42550			
Baseline	First action sent to Rank by the app	0.30944	0.28007 - 0.33880		
Hyper1	Uploaded	0.28454	0.26526 - 0.30382	<a href="#">Download</a>	<a href="#">Apply</a>
Random	Randomly generated ranks	0.24734	0.23300 - 0.26167		

Average reward vs Time (UTC)



# Tuning Personalizer – Feature Importance

[Home](#) > [test-sample](#) | [Evaluations](#) > [Evaluation summary](#) >

## Feature effectiveness

Status  
Completed

Start date for evaluation (UTC)  
3/18/2020

End date for evaluation (UTC)  
3/18/2020

[Read our responsible use guidelines to understand the impact of using different features when personalizing experiences.](#)

[Learn more about how Personalizer works with features.](#)

Feature effectiveness (high to low)

	Action.constant with Action.constant
	Context.nameAlice
	Context.nameAlice with Context.nameAlice
	Context.nameAlice with Action.constant
	Context.nameAlice with Action.idCappuccino
	Context.nameAlice with Action.idCold_brew
	Context.nameAlice with Action.idIced_mocha
	Context.nameAlice with Action.organicno
	Context.nameAlice with Action.organicyes
	Context.nameAlice with Action.originethiopia
	Context.nameAlice with Action.originkeny
	Context.nameAlice with Action.roastdark
	Context.nameAlice with Action.typehot
	Context.nameBob
	Context.nameBob with Context.nameBob
	Context.nameBob with Action.constant
	Context.nameBob with Action.idCappuccino
	Context.nameBob with Action.idIced_mocha
	Context.nameBob with Action.idLatte
	Context.nameBob with Action.organicno
	Context.nameBob with Action.organicyes
	Context.nameBob with Action.originethiopia
	Context.nameBob with Action.originkeny
	Context.nameBob with Action.roastlight
	Context.nameBob with Action.typecold
	Context.nameCathy with Action.organicyes
	Context.nameDave
	Context.nameDave with Context.nameDave

# Configuring Personalizer

Home > Microsoft.CognitiveServicesPersonalizer | Overview >

## demolInstance | Configuration

Cognitive Services

Search (Ctrl+/) << Save Discard Refresh

- Overview
- Activity log
- Access control (IAM)
- Tags
- Diagnose and solve problems

RESOURCE MANAGEMENT

- Quick start
- Configuration**
- Model and learning settings
- Evaluations
- Keys and Endpoint
- Pricing tier
- Networking
- Identity
- Billing By Subscription
- Properties
- Locks
- Export template

Monitoring

- Alerts
- Metrics
- Diagnostic settings
- Logs

### Personalizer configuration

Learning behavior

#### Rewards

After a Personalizer API Rank call, your application will call the Reward API with a score that is used to train the service.

[Read more about setting rewards](#)

Reward wait time ⓘ

Days	Hours	Minutes	Seconds
0	0	10	0

Default reward ⓘ

0

Reward aggregation ⓘ

Earliest

#### Exploration

Personalizer uses exploration to discover new patterns and adapt to changes in user behavior.

[Read more about choosing exploration proportion](#)

% of Rank calls to use for exploration

20

#### Model update frequency

How often should the model be updated?

Days	Hours	Minutes	Seconds
0	0	5	0

#### Data retention

No logs found

How many days should Personalizer retain log data?

# Documentation [aka.ms/PersonalizerDocs](https://aka.ms/PersonalizerDocs)

## Code Samples [aka.ms/PersonalizerSamples](https://aka.ms/PersonalizerSamples)

The screenshot shows the Microsoft Personalizer documentation page. The left sidebar contains a navigation menu with the following items: Overview, Quickstarts, Tutorials (highlighted with a red box), Concepts, How-to guides, Reference, and Resources. The Tutorials section includes links for 'Use Web app', 'Use Chat bot', and 'Use Azure Notebook'. The main content area is titled 'Personalizer documentation' and includes a sub-header 'Learn how to use Personalizer to allow your application to choose the best experience to show to your users, learning from their real-time behavior.' The main content is organized into several sections: 'About Personalizer' (with sub-sections Overview, What is Personalizer?, What's new, and Concept - highlighted with a red box), 'Create and use Personalizer loop' (with sub-sections Concept, Tutorial, How-to Guide, and Quickstart), 'Developing with Personalizer' (with sub-sections Get Started, Code Samples - highlighted with a red box, and REST APIs), 'About Reinforcement learning' (with sub-sections Overview, What is Reinforcement learning?, Concept, Exploration, Features, action, and context, Active and inactive events, and Rewards), 'Evaluate and improve service' (with sub-sections Concept, How-to Guide, and Quickstart), and 'Help and feedback' (with sub-sections Reference, Troubleshooting, Ask questions on Stack Overflow, and Influence service with UserVoice).

docs.microsoft.com/en-us/azure/cognitive-services/personalizer/

Filter by title

Personalizer Documentation

- Overview
  - What is Personalizer?
  - What's new
- Quickstarts
- Tutorials**
  - Use Web app
  - Use Chat bot
  - Use Azure Notebook
- Concepts
  - How Personalizer works
  - Where to use Personalizer
  - Terminology
  - Ethics & responsible use
- Fundamental concepts
- Analysis
- Scalability and performance
- How-to guides
  - Create Personalizer Resource
  - Configure Personalizer
  - Use Apprentice mode
  - Manage model and learning settings
  - Analyze with an offline evaluation
- Reference
  - Samples
  - REST API Reference
- SDKs
- Resources

Download PDF

### Personalizer documentation

Learn how to use Personalizer to allow your application to choose the best experience to show to your users, learning from their real-time behavior.

#### About Personalizer

- OVERVIEW
  - What is Personalizer?
- WHAT'S NEW
  - What's new
- CONCEPT
  - How Personalizer works
  - Where you can use Personalizer?
  - Ethics and responsible use

#### Create and use Personalizer loop

- CONCEPT
  - Choosing features and actions to personalize
  - How to calculate a reward
- TUTORIAL
  - Use Personalizer in a .NET web app
  - Use Personalizer with an Azure notebook
- HOW-TO GUIDE
  - How to create and configure Personalizer
- QUICKSTART
  - Using SDK

#### Developing with Personalizer

- GET STARTED
  - Develop Personalizer loop with .NET
    - NuGet package
    - NuGet reference documentation
  - GET STARTED
    - Develop Personalizer loop with Node.js
      - NPM package
  - GET STARTED
    - Develop Personalizer loop with Python
      - Pypi package
- GET STARTED
  - Code Samples
  - REST APIs

#### About Reinforcement learning

- OVERVIEW
  - What is Reinforcement learning?
- CONCEPT
  - Exploration
  - Features, action, and context
  - Active and inactive events
  - Rewards

#### Evaluate and improve service

- CONCEPT
  - Use Apprentice mode
  - Improve loop with offline evaluations
  - Active and inactive events
  - Scalability and performance
- HOW-TO GUIDE
  - Analyze success with offline evaluation

#### Help and feedback

- REFERENCE
  - Troubleshooting
  - Ask questions on Stack Overflow
  - Influence service with UserVoice

# More Information



Join **RL & Decision AI Community**:

Microsoft Teams group where you can connect directly with the Decision AI product team and the wider community

<https://aka.ms/JoinDecisionAI>

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# Agenda

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Adapting to the changing world

Introduction to reinforcement learning and contextual bandits

Personalizer overview

Apprentice mode

Making contextual bandits work in practice

Q&A