



das-Peak v2.1.5
VeriSaaS Release 2019Q4

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0. What's new?

This new version of das-Peak incorporates improved model for speaker verification functionalities. Briefly, this new version of das-Peak introduces the following changes:

- Accuracy of the Voice biometric model improved (EER=4.73 vs EER=3.69, 22% improvement)

1. das-Peak microservice

Voice biometrics is a state-of-the-art technology that allows a person to be validated by his voice. To do this, it takes into account the unique physical features of the vocal apparatus and features such as frequency, speed and accents. Together, these features generate a virtually unique digital voiceprint per person.

Veridas has developed an own speaker verification engine (**das-Peak**) that can be consumed in API mode, just like the rest of the digital authentication products it has. That is to say, **das-Peak** is a cloud-based solution.

Veridas' voice biometrics technology is based on the use of neural networks and has been evaluated at position number 13 out of 204 participants (**being the 4th best company**), worldwide, in the **NIST (National Institute of Standards and Testing, USA) SRE 2018**.

das-Peak determines the similarity between two audio recordings (in terms of the speakers present in them) using biometric algorithms. **das-Peak** engine allows to identify users voice **without** saying any password or passphrase (passive recognition). It is based on **text-independent technology**. This means that the biometric comparison is related to the voice characteristics and not to the content of the sentence. Anyway, the system is flexible to use well known phrases and fit customer requirements with an integration service.

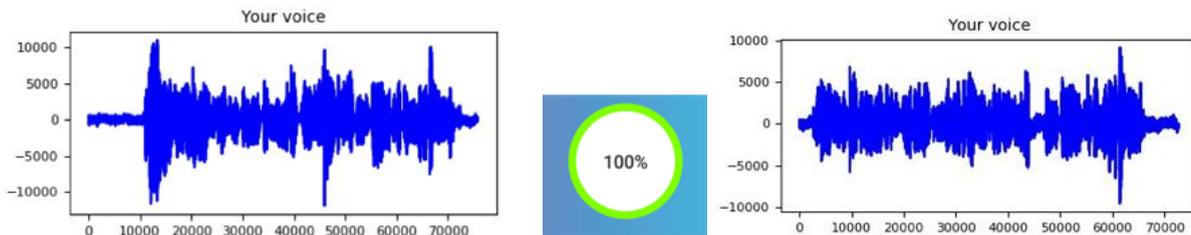
Within the voice biometrics field, two scenarios are typically handled:

- Verification: The process of checking the identity of a person by comparing two audios.
- Identification: The process of searching a person or a set of persons within a database of identities and its audio input data.

So far, **das-Peak** holds solution for the verification problem. Given two audio recordings, the system returns a score based on the similarity of both of them, not regarding to speech recognition

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but to the speakers present in them.

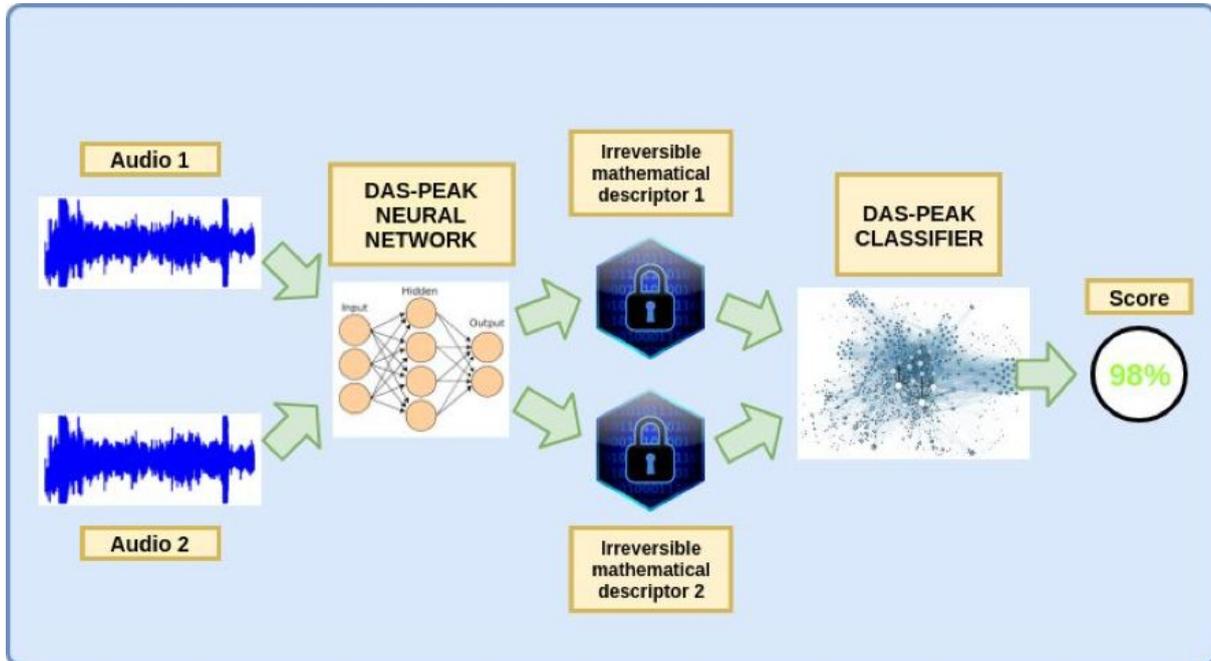


2. How does it work?

das-Peak is offered as an API REST format. The process to obtain the value of similarity between two audios is described below.

1. Two audio recordings are sent to the API.
2. The audio recordings are pre-processed. This process detects voice in the audio recordings (removing parts of silence) and analyzes the noise of the signals.
3. The audio recordings are converted into irreversible mathematical descriptors (voice-print).
4. Both mathematical descriptors are compared and a matching score between 0 and 1 is provided. This matching score represents the probability that the audios belong to the same person. The higher score, the higher probability to be the same person.
5. You can use this matching score to validate the identity of a user. You can select a threshold by consulting the FPR (False Positive Rate) and FNR (False Negative Rate) of each working point (see section 4).

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Veridas does not store any personal data in the cloud. All the user information (i.e., both the audio recordings as well as the processed data) is **immediately deleted**.

3. Main features

The main features of the das-Peak voice biometrics engine are:

- **Text-independent:** Allows you to compare phrases with different content. That is, the user does not have to remember any phrase or have to read the same phrase to be authenticated.
- **Minimum duration:** Allows verifying audios with a minimum voice duration of 5 seconds.
- **Verification time:** 0.4 seconds for two audios of 5 seconds.
- **Voice activity detection:** Compute the total quantity of voice in the input audio to accept a verification request.
- **Noise detection:** Compute the total quantity of noise in the audio input to accept a verification request.

To ensure optimal performance, a set of constraints must be followed by given audios. Veridas offers different proprietary SDKs for audio recording, and they are offered for different platforms

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(iOS, Android). Such SDKs ensure that capture is performed following the best conditions. Nevertheless, the most important conditions are:

- **Audio format:** WAV.
- **Number of channels:** Mono.
- **Bits per Sample:** 16.
- **Sampling frequency:** 8 kHz.

Anyway, das-Peak can process audios that met the above conditions, not just audios recorded with the SDK.

4. System quality report

The API offers functionality to perform voice verification between audio inputs. See Section 6 to get technical details about how this operation is exposed by the API.

Veridas has evaluated its voice biometrics model (das-Peak 2019Q4 version) with a internal database with different duration registration audios and different duration audios test (26.544 comparisons) in different acoustic conditions obtaining the values of False Positive Rates (FPR) and False Negative Rates (FNR) with different threshold values. The FPR is the probability to accept a non legit person and the FNR is the probability to reject a legit person. With this values it is possible to choose the desired working point of the voice biometric system.

A new calibration table has been computed with das-Peak 2019Q4 version. It consists of comparing enroll audios against test audios with different voice duration. Due to compare different voice length audio duration, the FPR and FNR values change for each similarity threshold, obtaining better results when the voice duration is longer. The table below shows how the FPR and FNR are affected by audio duration.

Similarity Threshold	Register=5s Verification=5s		Register=10s Verification=5s		Register=10s Verification=10s	
	FPR	FNR	FPR	FNR	FPR	FNR
0.5	1	2.01	1	0.7	1	0.1
0.55	0.7	2.4	0.7	0.9	0.7	0.15
0.6	0.5	3.02	0.5	1.3	0.5	0.26
0.65	0.3	3.8	0.3	1.6	0.39	0.29

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0.7	0.2	4.8	0.27	1.9	0.27	0.59
0.75	0.17	6.3	0.17	2.7	0.18	0.69
0.8	0.1	8.7	0.1	3.6	0.1	1.1
0.85	0.05	12.2	0.05	5.4	0.06	1.7
0.9	0.02	18.5	0.02	8.8	0.02	2.7
0.95	0.01	32.9	0.01	17.1	0.01	5.7

This calibration shows different security work points depending on the similarity threshold and the audios voice duration that are compared.

For example, If the use case is 5 seconds to register and 5 seconds to verify, with a threshold equal to 0.5, it is obtained FAR=1% and FRR=2.01%. In this case, 97.99% of the comparisons of a person voice and its corresponding voice registration will be considered as authentic, and only 1% of the cases comparing voices to different persons will be incorrectly classified as authentic.

5. API Considerations

The following are some general considerations about this API that must be taken into account before consuming the service.

5.1. Authentication

This service sits behind a gateway responsible for authenticating end users and routing requests. The authentication method is API key based.

5.2. Requests

- The multipart/form-data content type must be used on every request.
- The wav files sent to das-Peak must have a format extension (.wav).

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- The API is HTTP-based and uses SSL everywhere with valid certificates. For security reasons, customers should never trust das-Peak endpoints exposing invalid certificates.
- Endpoints attempt to conform to the design principles of Representational State Transfer (REST).
- The service includes an /alive endpoint that returns the 200 HTTP status code if the service is up and running. This can be used to check the service’s health.

All responses will be encoded using JSON, regardless of the accepted content-type specified by the client. Responses will return a suitable HTTP status code indicating if the request was successful (200 or 204 if nothing else is returned) or not (any other code). Responses will also include a code field in the JSON body that can provide more information about the concrete error on each case.

In general, successful responses will have the following format:

HTTP Status: 200 OK

```
{
  "data": {
    DATA
  }
}
```

or

In case of error:

Field	Description
exception	exception that raised the error
error	A message indicating what went wrong

Example:

```
{
  "exception": "InputException",
  "error": "The wav is not mono."
}
```

5.3 Versioning

The API version will be included in the URL, after the base url and before the endpoint:

`https://<base_url>/<service>/v{number:integer}/<endpoint>`

Non-backwards compatible changes will cause a version increment. As of now, the API only supports the **v1** version.

6. API Definition

This service is a REST API where the following endpoints are exposed:

Public Base URL (v1):

https://<base_url>/daspeak/v1/

Resources:

Method	Public URL	Description
GET	/alive	Checks if the service is up
POST	/similarity/wav2wav	Computes the voice similarity between two audio inputs, and returns how similar are both voices

6.1. Check if the service is alive

The service receives a GET request with no params, and returns a 200 status code indicating that the server is up.

GET /alive

Response: 200

Empty response.

Response: 500

Server error response.

Content-Type: application/json

exception

error message

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ServerError	Unexpected server fatal error
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6.2. Compute similarity between two audios

Computes the voice similarity between two audio inputs, and returns how similar are both voices.

POST /similarity/wav2wav

Request Body

Request for voice verification with two audios.

Name	Req.	Type	Description
audio_reference	yes	WAV file	Audio with the reference speaker voice. As multipart/form-data, it should be a file, as application/json, the file content encoded in base64.
audio_to_evaluate	yes	WAV file	Audio to evaluate with speaker voice. As multipart/form-data, it should be a file, as application/json, the file content encoded in base64.

Response: 200

Returns the confidence (or similarity) between both speaker voices, being more similar as much close this number is to one. The number is in range [0,1].

Content-Type: application/json

Name	Req.	Type	Description
confidence	yes	number	A probability number in range [0,1]
version	yes	string	API version

Response: 400

Request format error.

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Content-Type: application/json

exception	error message
InputException	The wav is not mono
InputException	The wav sample rate is not 8000
InputException	The wav bits per sample are not PCM_16
InputException	The wav duration is longer than 30s
InvalidAudio	Noise level exceeded
InvalidAudio	The duration of the voice is not enough: 2.5 s less than 3.0 s

Response: 500

Server error response.

Content-Type: application/json

exception	message
Exception	Error opening <_io.BytesIO object at 0x7f6baab4dbf8>: File contains data in an unknown format.

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