We do recognize broken machine using sound

Contact: pavel.konecny@neuronsw.com, +420 604 182 351
Neuron soundware builds an **auditory cortex** in machine
Build and train software which understands audio

Car engine issue detector

Pilot product

Escalators

Turbines

Trains

Windmills

Target products
How our technology works?

Then $H^{k+1} | H^k$ and $\alpha$ is computed as follows.

From the

$$d_{1}^{k+1} = x_{1}^{k+1} - x_{1}^{k+1} = x_{1} + \alpha (d_{1} + d_{2}) - x_{1}^{k+1} = (1 + \alpha) d_{1} + \alpha \cdot d_{2}$$
$$d_{2}^{k+1} = x_{2}^{k+1} - x_{2}^{k+1} = x_{2} + \alpha (d_{1} + d_{2}) - x_{2}^{k+1} = (1 + \alpha) d_{2} + \alpha \cdot d_{1}$$

we can obtain the numerator of (2.7) as

$$d_{1}^{k+1} + d_{2}^{k+1} = (1 + \alpha) d_{1} + \alpha \cdot d_{2} + (1 + \alpha) d_{2} + \alpha \cdot d_{1} = (1 + 2 \alpha) \cdot (d_{1} + d_{2})$$

and the denominator of (2.7) as

$$(d_{1}^{k+1})^2 d_{2}^{k+1} + (d_{2}^{k+1})^2 d_{1}^{k+1} = (1 + \alpha)^2 (d_{1}^2 + d_{2}^2) + 4 \alpha + 4 \alpha^2 (d_{1}^2 d_{2} + d_{2}^2 d_{1}) + \alpha^2 \cdot (d_{1}^2 + d_{2}^2)$$

Now, we can figure out the curvature in $x_{2}^{k+1}$ as

$$H^{k+1} = \frac{2 \cdot (d_{1}^{k+1} + d_{2}^{k+1})}{(d_{1}^{k+1})^2 + (d_{2}^{k+1})^2} \cdot d_{2}^{k+1}$$

$$= \frac{2 \cdot (1 + 2 \alpha) \cdot (d_{1} + d_{2})}{(1 + \alpha)^2 (d_{1}^2 + d_{2}^2) + 4 \alpha + 4 \alpha^2 (d_{1}^2 d_{2} + d_{2}^2 d_{1}) + \alpha^2 \cdot (d_{1}^2 + d_{2}^2)}$$

and with notation

$$f = (d_{2}^2 d_{1}) \quad g = (d_{1}^2 + d_{2}^2) \quad z = (d_{1}^2 + d_{2}^2)$$

we can now redefine previous expression as

$$H^{k+1} = \frac{2 \cdot (1 + 2 \alpha) g}{(1 + \alpha)^2 z + 4 \alpha (1 + \alpha) f + \alpha^2 z^2}$$

Now we will compute the coefficient $\alpha$ from quadratic equation

$$\alpha^2 \left( H^{k+1} (2z + 4f) \right) + \alpha \left( H^{k+1} (2z + 4f) - 4g \right) + H^{k+1} z - 2g = 0$$

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How our technology works?

Training data  Magic  Smart applications
How our technology works?

Training data → Magic Learning → Smart applications
Audio type of data pre-processing

Sound/Vibration represents a change of pressure

Spectrum representation – lose the time dependency of the signal

Spectrogram – combines frequency analysis and time
Spectrograms are further processed

Spectrograms fully represent the original sound. However, the amount of data has to be reduced to a level better suited for deep learning (e.g., cepstrum and Neuron soundware unique method).

Convolutional neural networks are trained to recognize patterns in sound “maps”.

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Classification of the sound

Neuron soundware applies:
- Combination of convolutional and fully connected layers
- 1D and 2D convolutions
- ReLU/ELU for non-linear signals
- Dropout
- Recurrent LSTM
Examples from an image classification

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NeuronSW analytical platform - integrated SW and HW solution

Deep Learning

audio stream

expert knowledge

issue detection & prediction

Diagnostic neural network

adaptation

acoustic model
Escalator analysis comparison

Prehrat' zvuk eskalátora

OK
Ballustrade
Chain
Engine
Creaking steps
Tensor
Track
Vibrations

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OK
Ballustrade
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Creaking steps
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Track
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AI Design
We are looking for customers to challenge our technology.

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