PERFECT COFFEE ROASTING WITH TINYML SOUND SENSING

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tinyML EMEA 2021

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ROEST

Audio Machine Learning

Sound Event Detection

Acoustic Anomaly Detection

Data Platform

Hardware

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Noise Monitoring

61 dB

Noise and Acoustics Rating

S   C   61 dB

Safety	**Very good**	Hearing protection not neccessary
Concentration	**Not so good**	Recommend reducing by 10 dB for increased productivity and satisfaction

Acoustic Anomaly Detected

78 dB

Details	High frequency sounds 40% above normal
Cause	Unknown

Inspection scheduled   Work order #4397

Machine Monitoring

ROASTING COFFEE

Target roast
Desired stop point

Imminent fire

Full French roast

Full city+ roast

city+ roast

1st crack under way

Brown stage

Yellow-Tan stage

Full city roast

1st crack finishes

1st crack begin

light Brown stage

Early yellow stage

Vienna - Light French roast

Fully carbonized

30 seconds

1st crack
Beans *pop* like popcorn

Start to pale

Green / Un roasted
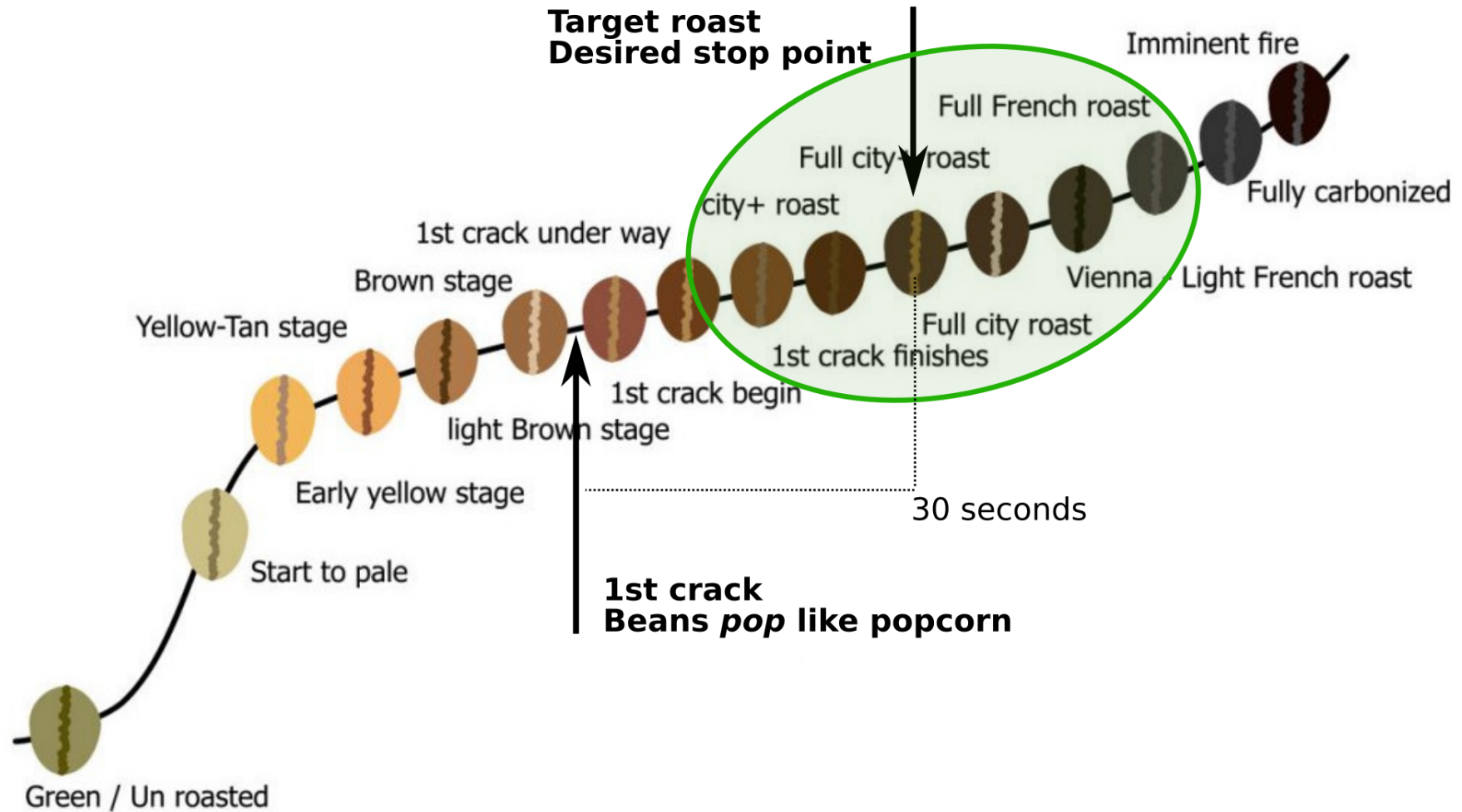
DOING IT MANUALLY

AUTOMATIC FIRST CRACK DETECTION

Sound

Microphone

Preprocessing

Spectrogram

Neural Network

Detected cracks
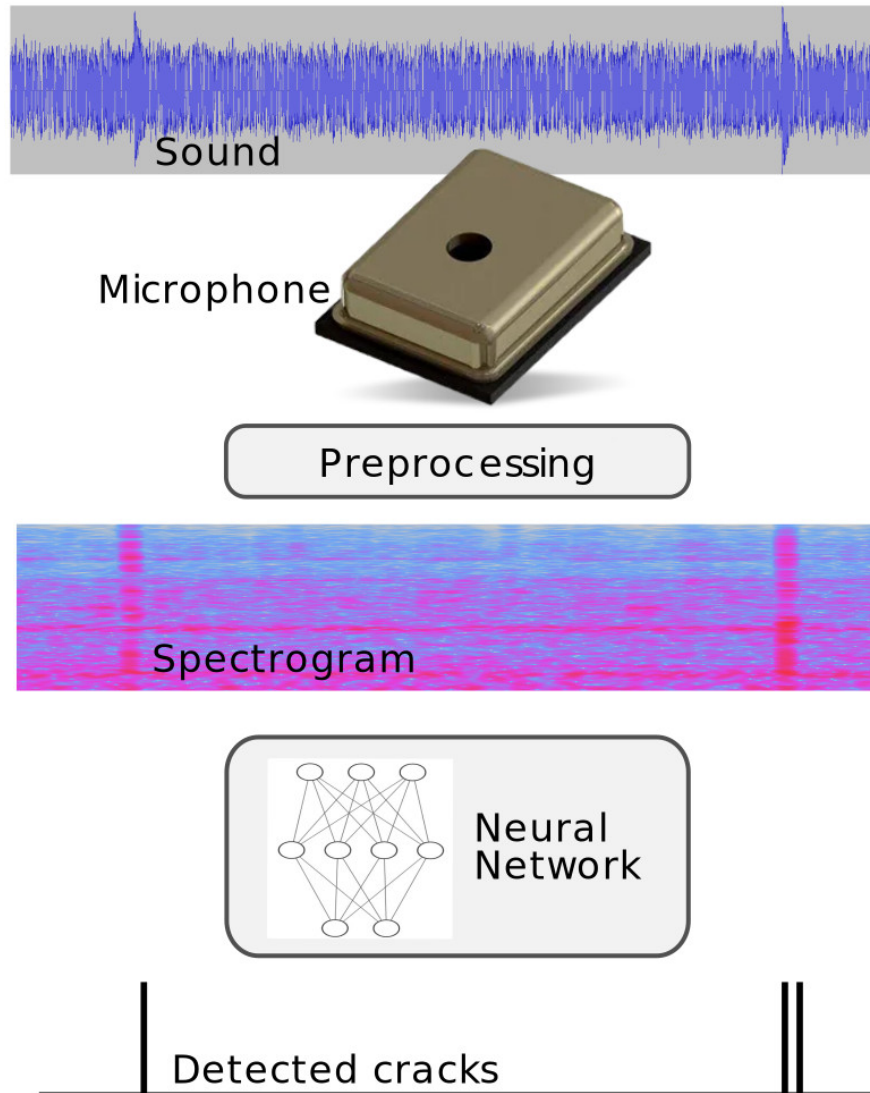
Deep-learning framework

TensorFlow

TinyML Inference Engine

STM32 Cube.AI

Microcontroller

STM32L4

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Models for Sound Event Detection
Customized firmware
Custom PCB hardware

DEMO VIDEO

0:00 / 0:29

Benefits of fully automated roasting

- Operator can do other things while machine runs
- Improved consistency
- Works well regardless of operator skill level

Summary

- Acoustic detection of first crack
- Shipping on Roest coffee roasters since 2020
- Using TinyML solution developed by Soundsensing

WANT TO SENSE ACTIVITIES OR MONITOR MACHINERY USING SOUND AND MACHINE LEARNING?

contact@soundsensing.no

TinyML EMEA 2021: Perfect coffee roasting with TinyML sound sensing

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BONUS

Bonus slides after this point

MORE RESOURCES

Machine Hearing. ML on Audio

- github.com/jonnor/machinehearing

Machine Learning for Embedded / IoT

- github.com/jonnor/embeddedml

Thesis Report & Code

- github.com/jonnor/ESC-CNN-microcontroller

WANT THE WORLDS BEST COFFEE ROASTER?

sales@roestcoffee.com

TINY ML

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