NEURO-HEADSET
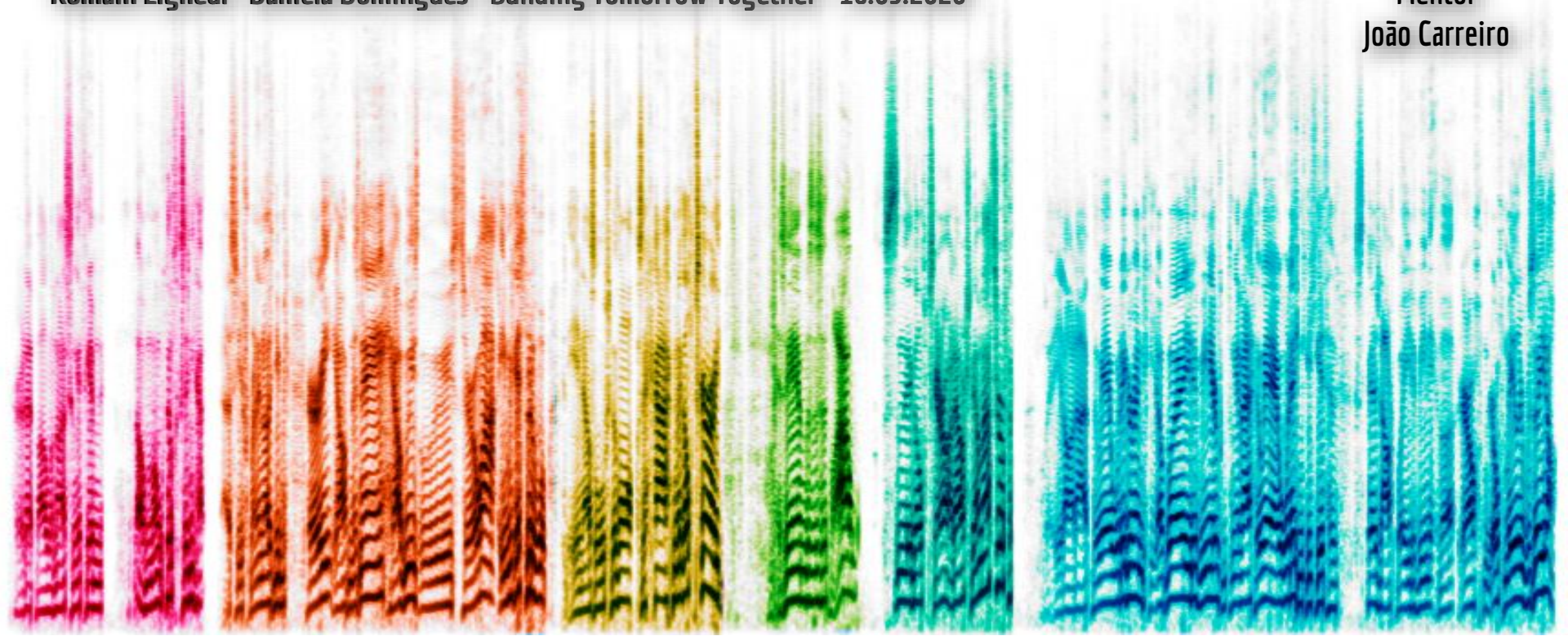## A multimodal monitoring device for neurological disorders

Romain Ligneul · Daniela Domingues · Building Tomorrow Together · 16.09.2020
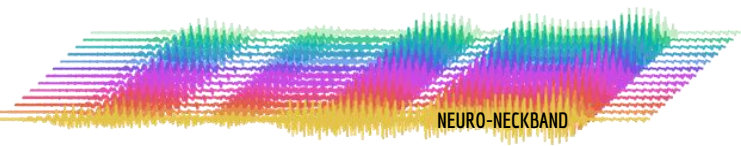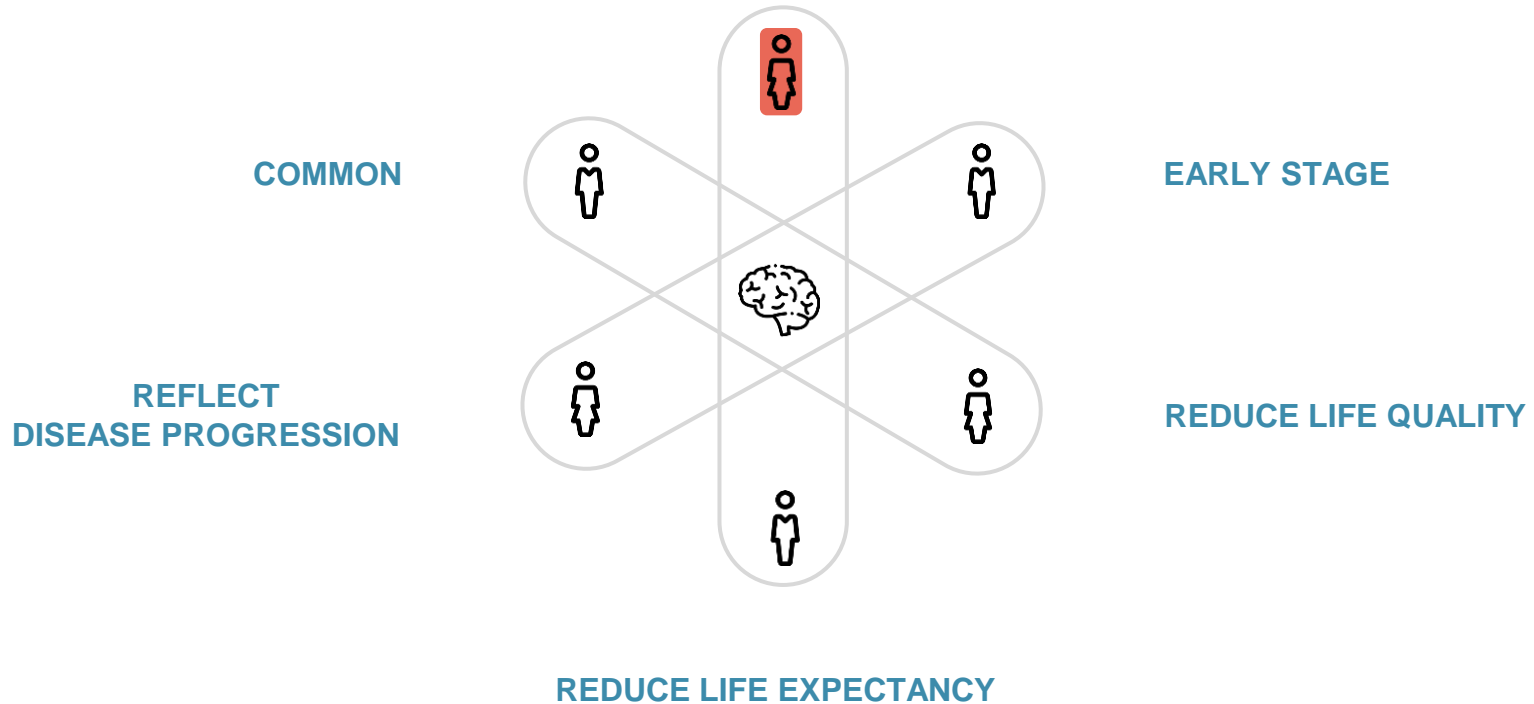
Mentor
João Carreiro

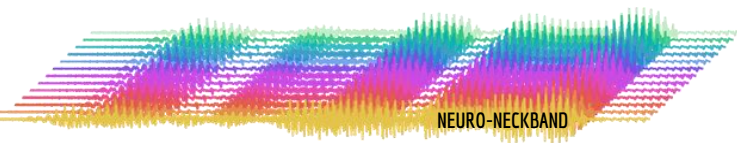Speech impairments (dysarthria) and swallowing dysfunctions (dysphagia)

COMMON

EARLY STAGE

REFLECT
DISEASE PROGRESSION

REDUCE LIFE QUALITY

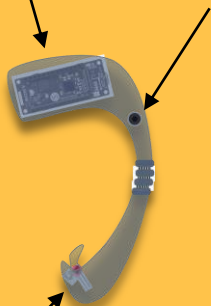REDUCE LIFE EXPECTANCY

NEURO-NECKBAND

The solution

air microphone, accelerometer

bone conduction microphone

pulse oximeter

Measurements

Swallowing
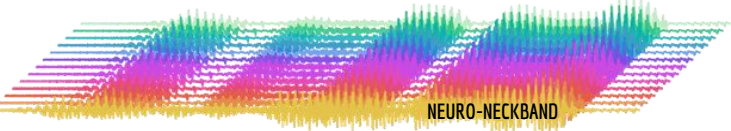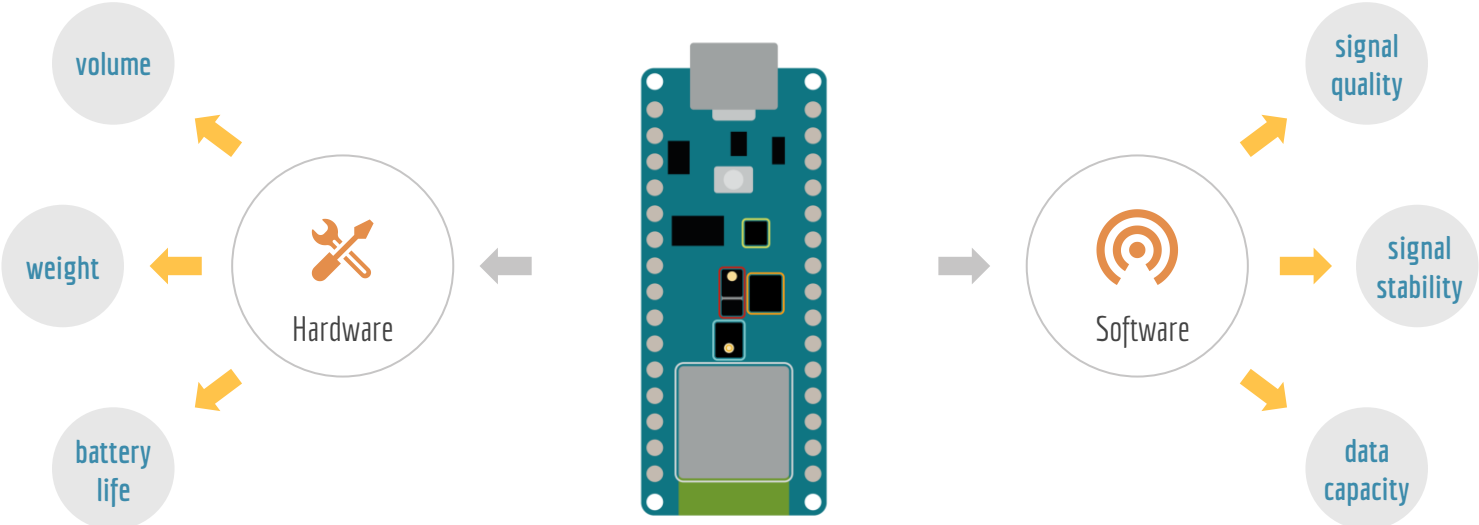Coughing
Vocalization

Heart rate
Locomotor activity

Head wearable + analysis software

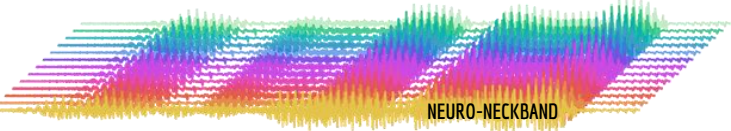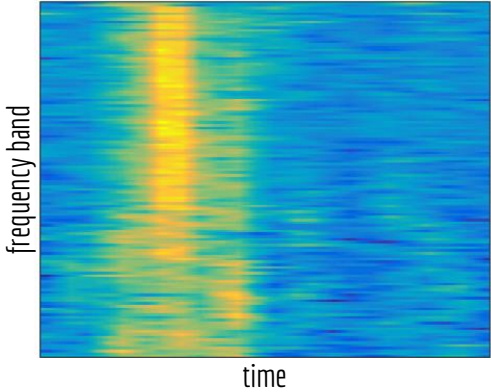New biomarkers → better diagnosis + personalized treatment

Demo and progress

Prototype

volume

weight

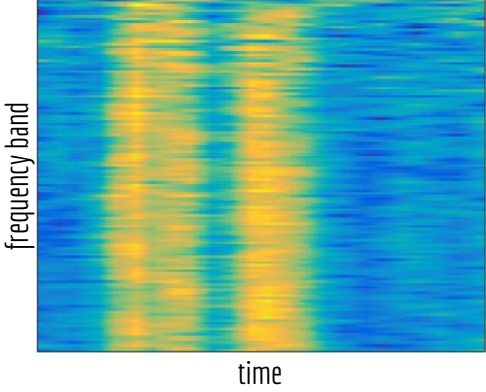Hardware

battery
life

Software

signal
quality

signal
stability

data
capacity

Demo and progress

Pilot data

First subject

Swallowing ⟶ Co-occurrence ⟵ Coughing
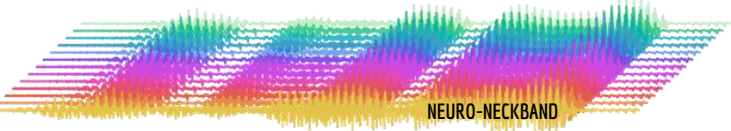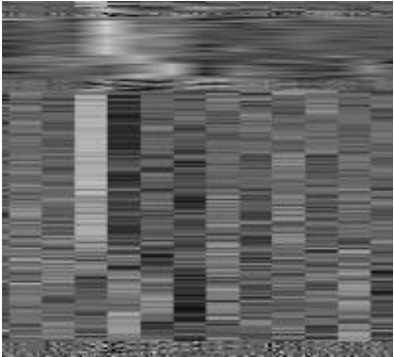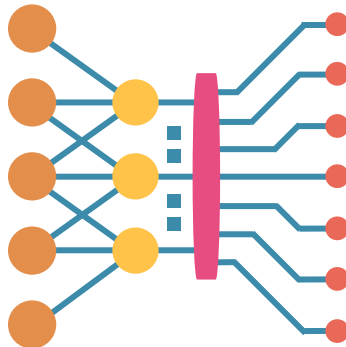
↓

Risk of aspiration pneumonia and choking
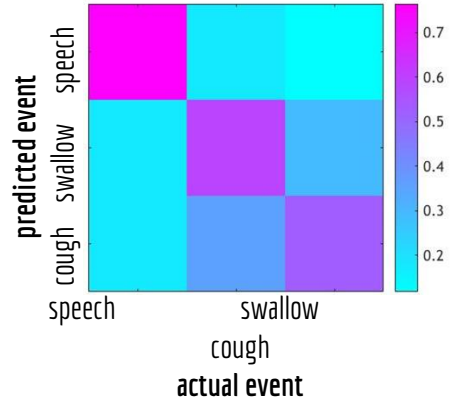
Demo and progress

Event classification
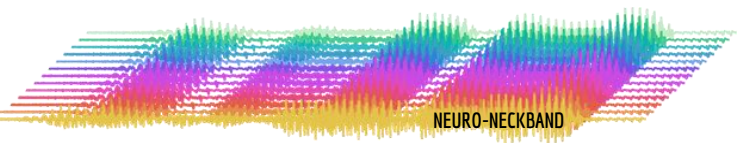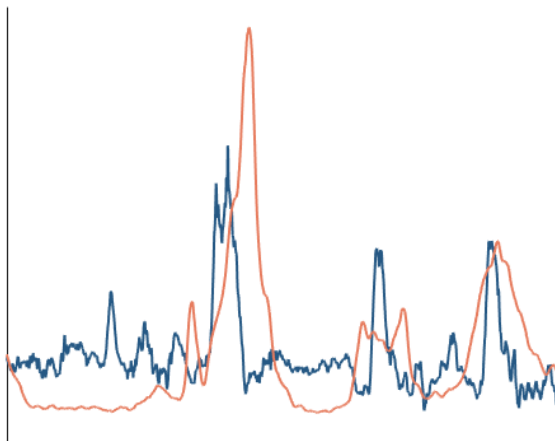

Sensor data in time   Neural net sklearn   **Event prediction**

Signal reconstruction

Reconstructing surface EMG signal from
accelerometer and microphone data

Competitors
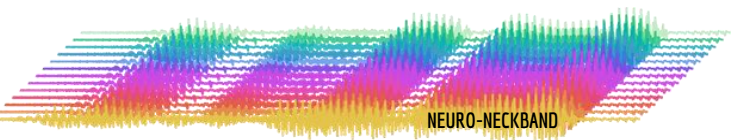
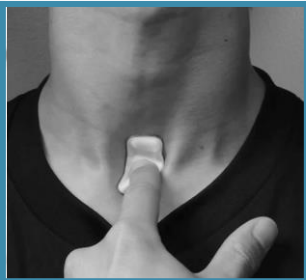|	Purdue University	Northwestern University	Universidade Nova	Champalimaud Foundation
Voice	👎	👍	👎	👍
Coughing	👍	👍	👍	👍
Muscle activity	👍	👎	👎	👍
Pulse oximetry	👎	👍	👎	👍
Activity tracker & Calls	👎	👎	👎	👍

Market and target
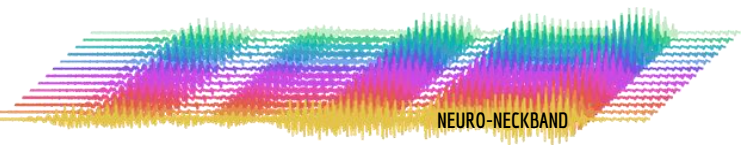
A monitoring and diagnostic tool

end users: **patients**

customers: **doctors**

customers: **researchers**

Community and Co-Creation

Potential partnerships
Nursing homes, pharmaceutical companies, hospitals

NEURO-NECKBAND
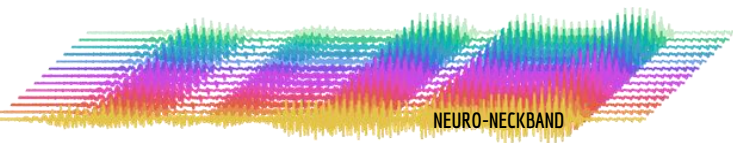
Market and target

A monitoring and diagnostic tool

Potential market
≃ 100 millions worldwide

Parkinson
Up to 90%

Multiple sclerosis
Up to 50%

Dysarthria
Dysphagia

Amyotrophic lateral sclerosis
Up to 95%

Stroke
Up to 50 %

Huntington
Up to 70%

NEURO-NECKBAND

ASHA
American
Speech-Language-Hearing
Association

5
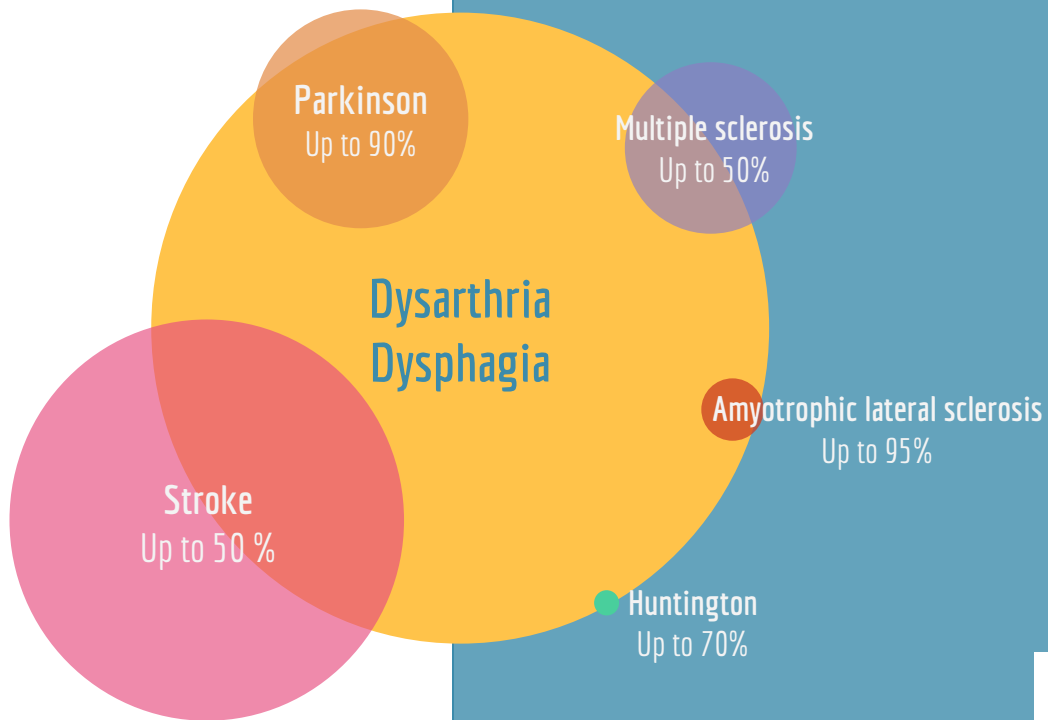
Market and target
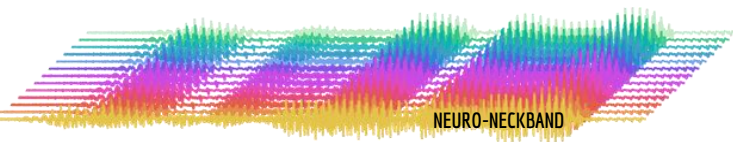
Parkinson disease as a validation model

Statistics:

20 000 people in Portugal

1 million people in the US

10 million people worldwide

Parkinson
Up to 90%

Dysarthria
Dysphagia

NEURO-NECKBAND

Daniela Domingues

Romain Ligneul

System neuroscience
Bioengineering
Microcontrollers and data analysis
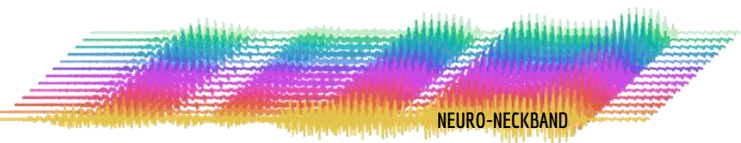
New Parkinson medications

System neuroscience
Cognitive neuroscience
Microcontrollers and data analysis

Computational modeling and machine learning
Neuromodulation

Main activities and resources
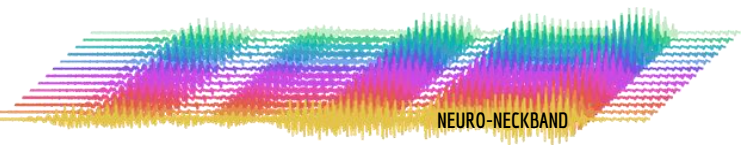
From prototype to commercial product

Prototype Tests with partner institutions	Hardware & Software optimisation Tests with partner institutions	Clinical trials Predictive models

Pre-production phase
12 months
300-500k€

Freelance industrial designer
Research technician
Hardware engineer

Development phase
24 months
1-2M€

Developers (front-end, back-end, firmware)
Designers (industrial, graphics, UX)
Marketing consultant
Hardware engineer +1
Research technician

Commercial phase
24 months
?

Data scientists
Sales manager
HR manager
Consultants
Webmaster

Our vision
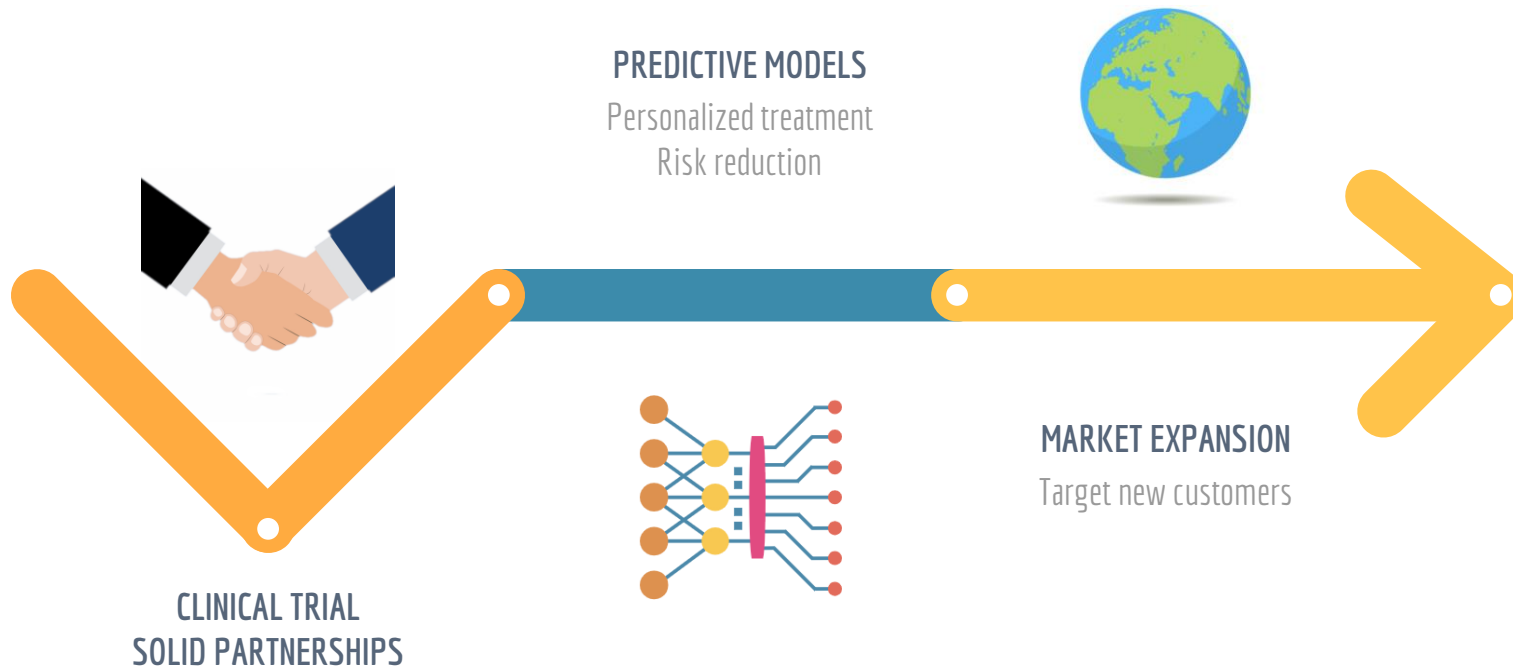
PREDICTIVE MODELS

Personalized treatment
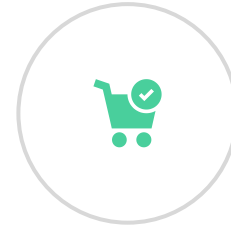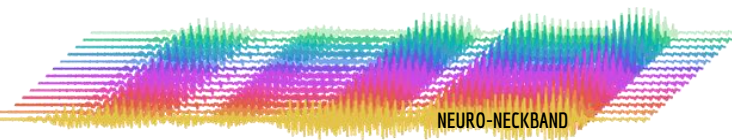Risk reduction

**CLINICAL TRIAL
SOLID PARTNERSHIPS**

MARKET EXPANSION

Target new customers

NEURO-HEADSET
A multimodal monitoring device for neurological disorders

Romain Ligneul · romain.ligneul@research.fchampalimaud.org
Daniela Domingues · daniela.domingues@research.fchampalimaud.org

Mentor
João Carreiro

BUILDING TOMORROW TOGETHER

imatch

Covid-19 as another market opportunity

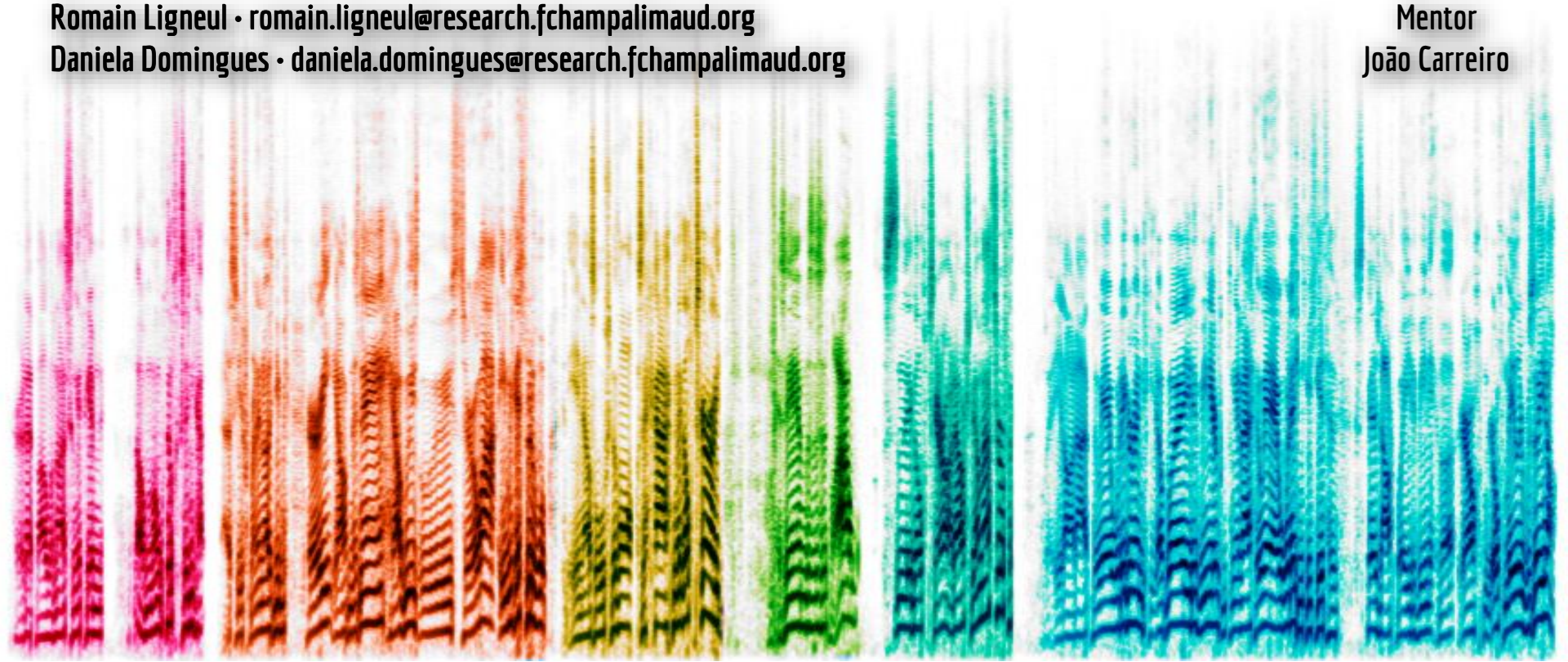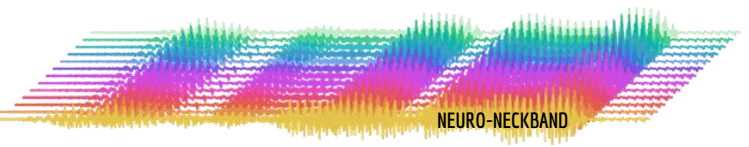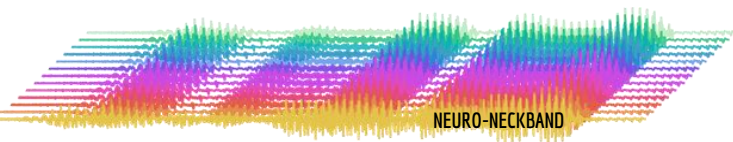NEURO-NECKBAND

MIT News
ON CAMPUS AND AROUND THE WORLD

✉ SUBSCRIBE

Signs of Covid-19 may be hidden in speech signals

Processing vocal recordings of infected but asymptomatic people reveals potential indicators of Covid-19.

Kylie Foy | Lincoln Laboratory
July 8, 2020

Anticipated costs per prototype

Microcontroller
Teensy 4.0 - 16€

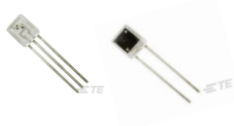**Accelerometer**
MCU6050 - 3€

3D printed case
5-10€

Battery module
JYE118 - 3€ / CE04375 - 10€

Bone conduction microphone
VM1000 - 1€

Oximeter
200582M - 3€ - 200696 - 2€

Air microphone
VM2020 - 1€

Other materials
Wires, LEDs, speaker - 4€

Total manufacturing
cost per unit

About 50€