Contents

1. My background
2. Work philosophy
3. Project demo or code/architecture review
4. Questions

slide deck source: github.com/tdemarcy/slides-2020-12-07

1. My background

Profile analysis

Ask my referals:

- Nicholas Ayache
- Hervé Delingette
- Dan Gnansia
- Cédric Briand
- Benjamin Braga
- Jan Margeta

Achievements

1. Bringing a new approach at Oticon Medical

Oticon Medical

- Neurelec until 2013 (PhD 1st year)
- Hardware company
- Less than 10% of market share

Data-driven approach

Throughout the product life cycle:

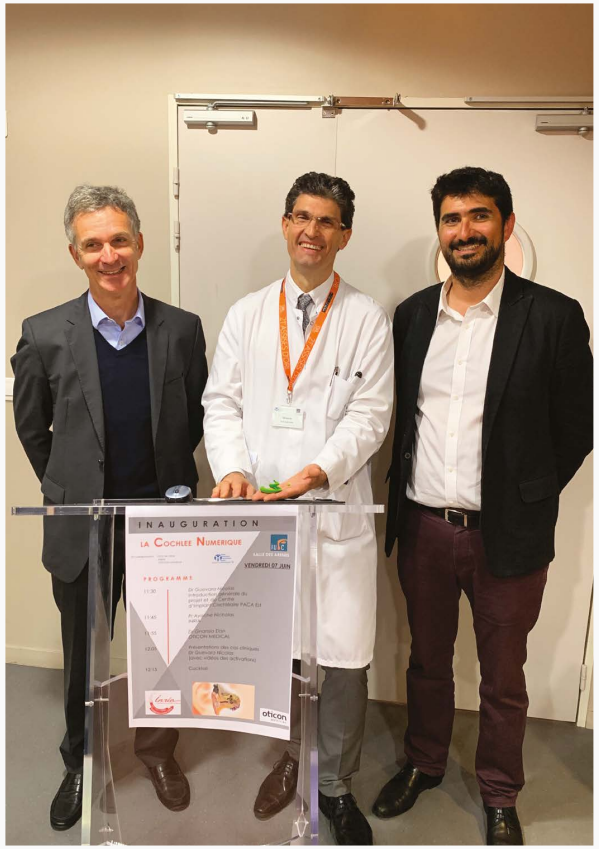
conception → implantation → fitting

How?

[x] Preop. anatomy reconstruction (PhD, using Bayesian inference)
    → Surgery planning
[x] Postop. electrode reconstruction
    → Design review
[x] Modality registration
    → Insertion depth and trauma evaluation
[x] Fitting (Hz, nC) using images, impedences and demographics data
[ ] Nerve health modelisation using objective measures (e.g. eCAPs)

Press

- l'équipe de recherche clinique d'Oticon Medical, dirigée par **Dan Gnansia**, a financé le projet et apporté son expertise de la technologie d'implantation cochléaire. L'entreprise implantée sur Sophia est un des



"Thomas Demarcy, jeune chercheur de l'équipe de Nicholas Ayache à Inria Sophia Antipolis, a développé le modèle mathématique de reconstruction tridimensionnelle de la cochlée dans le cadre de sa thèse"

Nicholas Ayache, Inria

Nicolas Guevara,
Institut Universitaire de la Face et du Cou, CHU de Nice

Dan Gnansia, Oticon Medical

A research project to visualise cochlear anatomy

The aim of the research partnership which involved the three teams was to develop advanced image processing methods to reconstruct the cochlea in three dimensions from low resolution scanner images generated in clinical practice. The project commenced at the end of 2013 had two main objectives: to provide support to medical teams in the surgical planning of cochlear implantation and to evaluate the quality of the insertion by visualising the placement of the electrodes. It also made it possible to document the individual anatomical variations of the cochlea.

This partnership benefited from the complementary expertise of three groups:

- the Nice University Hospital with the contribution of two teams. That of **Nicolas Guevara**, ENT surgeon responsible for the cochlear implantation centre of the University Institute of the Face and Neck, the only centre authorised to put these implants in adults in the PACA-East region. He provided his expertise in cochlear anatomy and implantation surgery as well as pre- and postoperative scans to build and test the model. The team of Charles Raffaelli, radiologist at the Pasteur Hospital, made it possible to document cochlear anatomy by accessing a large database of brain scans made in different contexts.

- **Nicholas Ayache's** team at Inria Sophia Antipolis specialises in the analysis of biomedical images and digital medicine to support medical and surgical practice. It welcomed Thomas Demarcy, young researcher who developed the mathematical model of three-dimensional reconstruction of the cochlea as part of his thesis under the responsibility of Hervé Delingette.

- Oticon Medical's clinical research team, led by

Achievements

1. Bringing a new approach at Oticon Medical
2. Initial technological design choices approved a posteriori by top management

Technological design

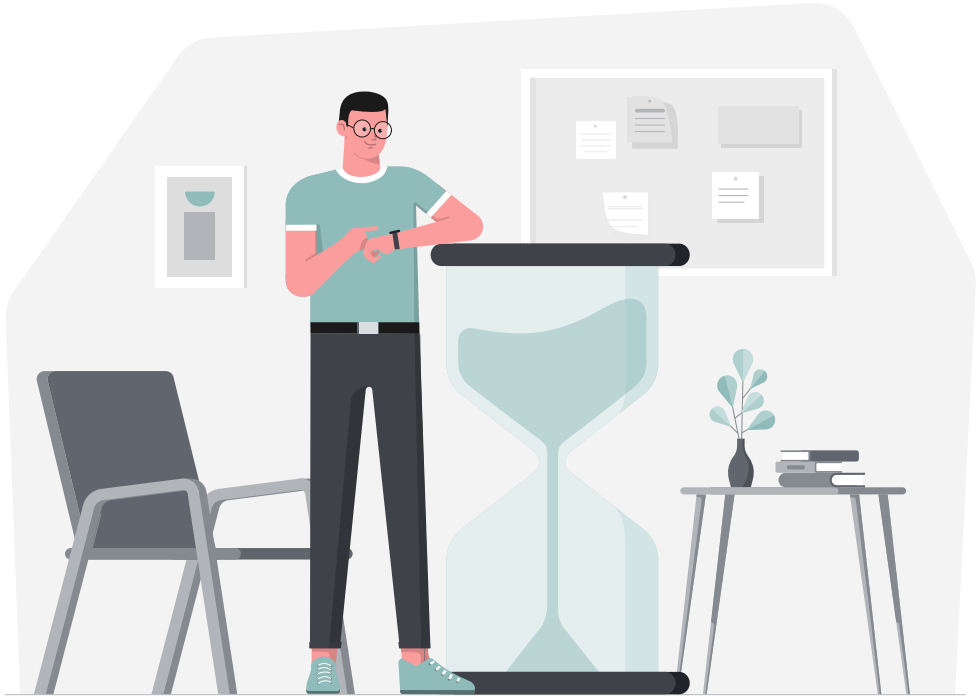
- Use of actively maintained, cross-platform, multiple programming languages (C++, Python, JavaScript, etc.) libraries
- Cloud-based and GDPR compliant
- DevOps automation: Automated testing and container deployment, scaling, and management

Why leaving Oticon Medical?

2. Work philosophy

Quick-and-dirty?

- quick prototyping
- short-term and long-term velocity
- needs for documentation

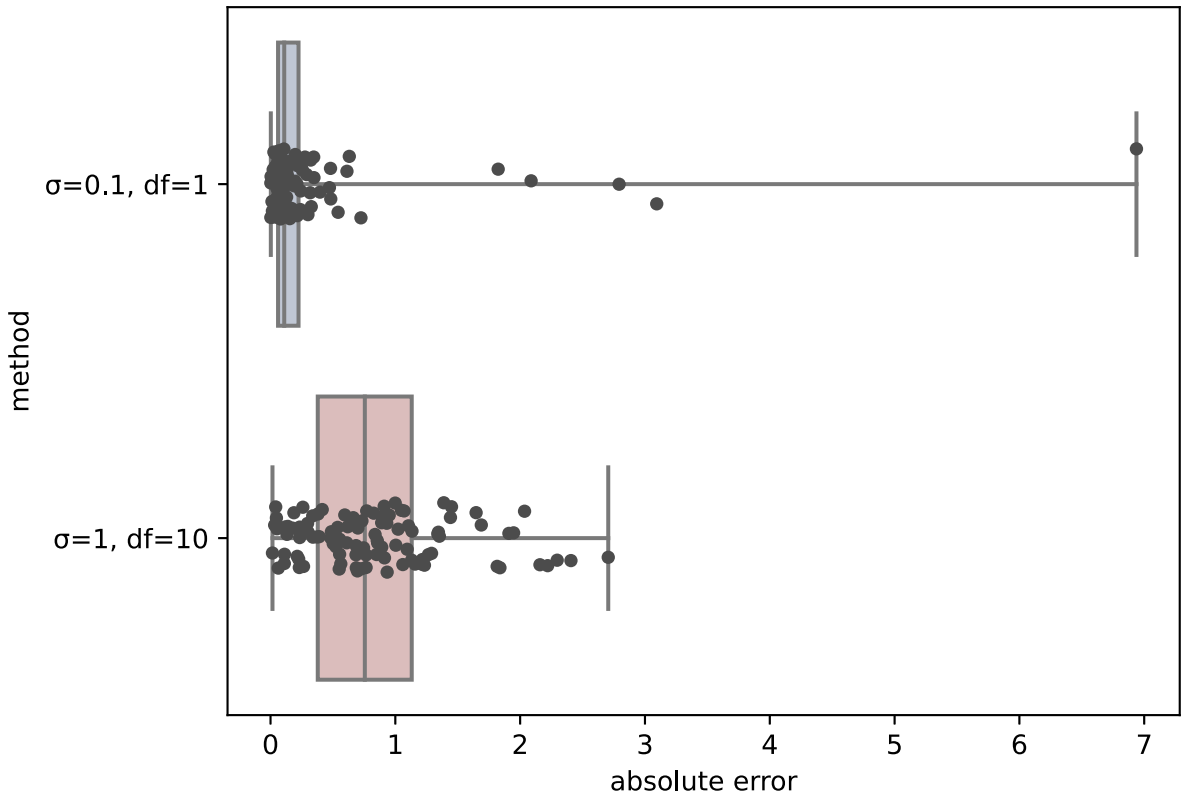


Accuracy vs. Robustness

```
n_sample = 100
error = pd.DataFrame(
    {
        "σ=0.1, df=1": random.standard_t(1, n_sample) * 0.1,
        "σ=1, df=10": random.standard_t(10, n_sample) * 1,
    }
)
abs_error = pd.melt(np.abs(error), var_name="method", value_name="absolute error")

plot_values = {"x": "method", "y": "absolute error", "data": abs_error}
sns.boxplot(**plot_values, **box_options)
sns.stripplot(**plot_values, **strip_options)
```

Accuracy vs. Robustness



*valid for medical UX

From MIC to CAI

Medical Image Computing and Computer Assisted Interventions

My 2 keywords rule

- **Computer vision**

  or
- **Medical device**

  or
- **Data science**

Thomas Demarcy's interview @ Caranx Medical