

# Design of a diagnosis and follow-up platform for patients with chronic headaches

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Intro

Machine learning - DT's

Platform requirements

Genetic merging of DT's

Mobile application

Visualization

Backend and data exposure

Conclusion & future work

Intro

Current process UH Ghent

Platform requirements

Mobile application

Backend and data exposure

Machine learning - DT's

Genetic merging of DT's

Visualization

Conclusion & future work

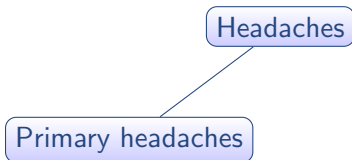
# Introduction



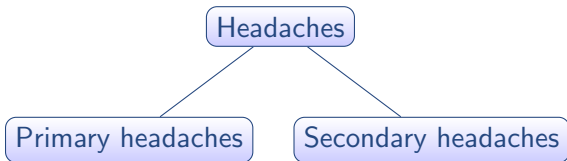
# Headaches

Headaches

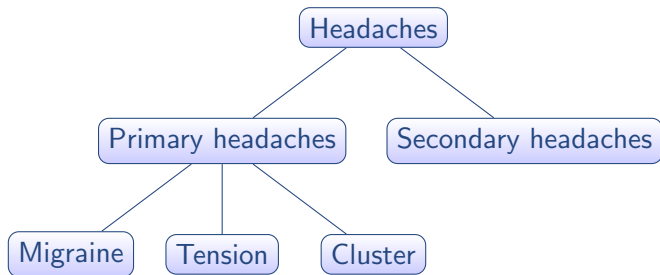
# Headaches



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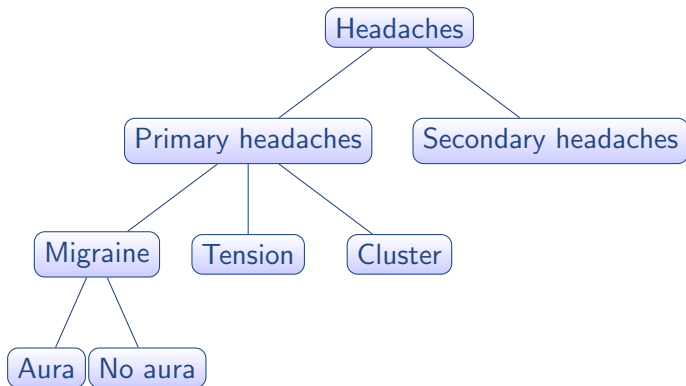


# Headaches





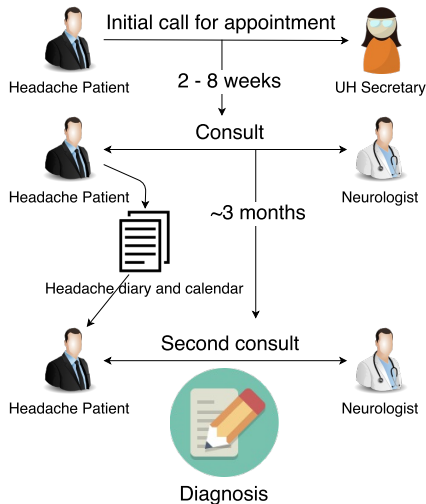
# Headaches



# Current process UH Ghent

Current process at UH Ghent is:

- ▶ Not digital
- ▶ cumbersome
- ▶ long-lasting



So there is need for a better (digital) alternative! This alternative has to:

- ▶ capture at least the same information as current solution
- ▶ be more efficient
- ▶ provide a second opinion for the doctors (auto-diagnose)

Intro

Machine learning - DT's

Platform requirements

Genetic merging of DT's

Mobile application

Visualization

Backend and data exposure

Conclusion & future work

# Platform requirements

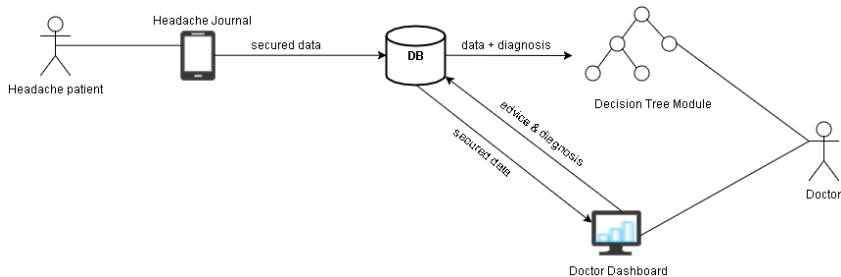
Our proposed alternative consists of:

- ▶ Headache journal: mobile app
- ▶ Doctor Dashboard: web application
- ▶ Machine learning module: auto-classify

Solution non-functional requirements:

- ▶ Security
- ▶ Availability
- ▶ Performance
- ▶ Usability

# Platform requirements



Intro

Machine learning - DT's

Platform requirements

Genetic merging of DT's

Mobile application

Development paradigms

Chronicals

Visualization

Conclusion & future work

Backend and data exposure



# Mobile Application

Why create a new application?

## Competition

- ▶ Migraine Buddy
- ▶ Headache Diary
- ▶ Pfizer headache journal

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All good, but:

# Mobile Application

Why create a new application?

## Competition

- ▶ Migraine Buddy
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All good, but:

- ▶ none offers usable data export
- ▶ none captures all data needed

# Development paradigms

Different kinds of approaches for mobile application development:

- ▶ Web application
- ▶ Hybrid application
- ▶ Native application

→ How do we choose?

# Web application

Webapps are developed once and can be viewed on (almost) all smartphones (via built-in web engine).

- + “write once, run everywhere”  $\Rightarrow$  lower cost
- + No installation required
- limited use of device specific features (GPS, camera, ...)
- **Not all devices same web engines  $\Rightarrow$  other view**
- No native look and feel

$\Rightarrow$  **No web application**

## Native application

Native apps are developed once for each OS and installed on the device.

- + Best performance (optimized machine code at compile time)
- + Device specific features usable (GPS, camera, ...)
- + Native look and feel
- **Write code for each OS (very costly dev + maintenance)**
- Installation required

⇒ Native application?

## Hybrid application

Hybrid apps are developed once and installed on the device. It uses the devices internal web engine, but has more control than web applications.

- + “write once, run everywhere”  $\Rightarrow$  lower cost
- + Better performance (semi-optimized machine code)
- + Device specific features usable (GPS, camera, ...)
- + Native look and feel (using libraries)
- Installation required
- **Not all devices same web engines  $\Rightarrow$  other view (but manageable)**

$\Rightarrow$  **Hybrid application?**

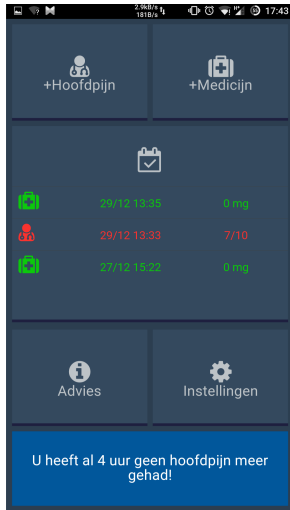
## Hybrdid vs Native

	Native	Cross-platform
+	+ Native UX	+ 1 language
	+ device-specific features	+ Write once, run everywhere
	+ Better performance	+ Less maintenance
-	- Multiple languages	- Slower (lower performance)
	- Time consuming (development)	- Less device specific features
		- Harder to release online (Play Store/App Store)



# Hybrdid vs Native

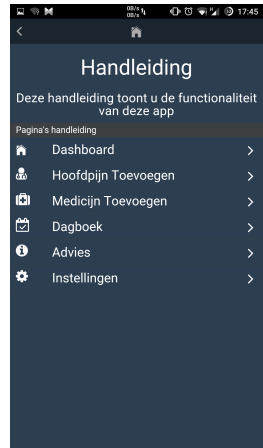
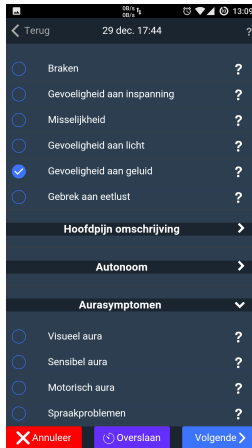
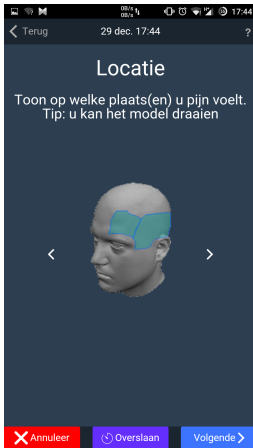
	Native	Cross-platform
+	<ul style="list-style-type: none"> <li>+ Native UX</li> <li>+ device-specific features</li> <li>+ Better performance</li> </ul>	<ul style="list-style-type: none"> <li>+ 1 language</li> <li>+ Write once, run everywhere</li> <li>+ Less maintenance</li> </ul>
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# Chronicals



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Intro

Machine learning - DT's

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Visualization

Backend and data exposure

Conclusion & future work

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Genetic merging of DT's

Mobile application

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Conclusion & future work

Intro

Machine learning - DT's

Platform requirements

Genetic merging of DT's

Mobile application

Visualization

Backend and data exposure

Conclusion & future work

# Many different induction algorithms



C4.5 (C5.0)



CART



QUEST

...

→ **Which tree is the most beautiful?**

# Current ensembles lack interpretability

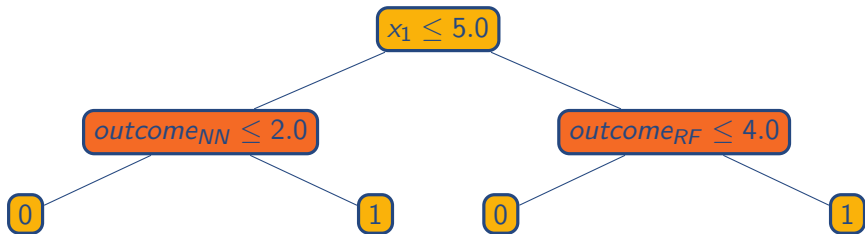
**Boosting, bagging, random forests, etc.** require majority voting (classification) or mean calculation (regression) to obtain prediction





## Current ensembles lack interpretability

The final decision tree obtained by **stacking** contains uninterpretable internal nodes

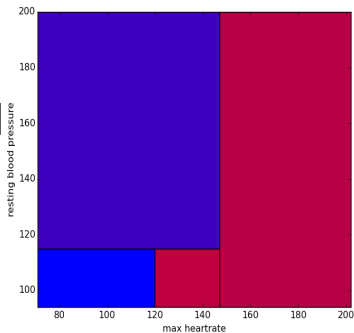
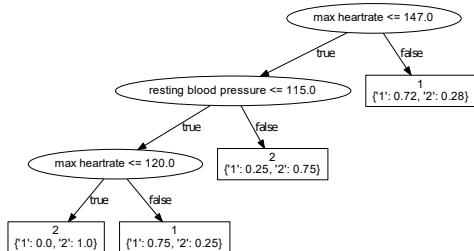


## Decision tree $\rightarrow$ decision space

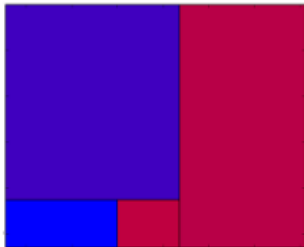
### Converting decision trees to decision spaces

We can define a one-to-one mapping between a decision tree and a set of  $k$ -dimensional hyperplanes ( $k = \text{\#features}$ ), called **decision space**. Each node in the decision tree corresponds to a hyperplane in the decision space.

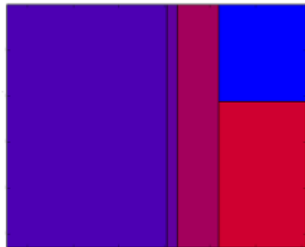
## Decision tree → decision space



# Merging decision spaces

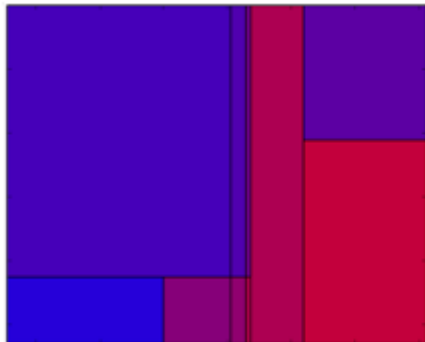


Genetic merging of DT's



Merging different DT's

# Merging decision spaces



Intro

Machine learning - DT's

Platform requirements

Genetic merging of DT's

Mobile application

Visualization

Backend and data exposure

Conclusion & future work

Intro

Machine learning - DT's

Platform requirements

Genetic merging of DT's

Mobile application

Visualization

Backend and data exposure

Conclusion & future work

## Bedankt

### Bedank voor uw aandacht

No written word,  
No spoken plea,  
Can teach the youth what they should be,  
Nor all the books on all the shelves,  
It's what the teachers are themselves



Intro

Platform requirements

Mobile application

Backend and data exposure

Machine learning - DT's

Genetic merging of DT's

Visualization

Conclusion & future work