Towards smart solutions for the universal assessment of food intake

Mini-symposium, November 15th 2021, Phenomea Plaza, WUR Campus

Setting the stage – Mireille Baart and Yannick Weesepoel

Hybrid and Physical meeting details

- Presentation + Sound + Speaker
  - Name: *Yannick Weesepoel*

- Extra cam (tablet): *Hybrid camera*

- Please mute!

- Questions after speaker finishes
  - Hybrid: Raise hand or in chat

- Please keep to COVID measures as ususal!

Goal of the symposium

- To **Sync** and **Think** on (photonic) smart solutions for measuring food intake

Subsidiary framework

- NWA route 'Measuring and Detecting: anything, anytime, anywhere'
- Dutch National Research Agenda route Measuring and Detecting

- Startimpulse project → Delivering results fast

- WU and WR collaborated in WP2 on measuring of food intake

- Project kicked of in 2018 and will be finished in 2021

Program (i)

- NWA project group

13.00 Welcome, Setting the stage. Human nutrition perspective - Mireille Baart (WU-HNE), Technical perspective – Yannick Weesepoel (WFSR)

13.20 RGB-Depth sensing for volume estimation: a vegetable case - Freek Daniels (WFBR)

13.40 Hyperspectral imaging for compositional information of sandwiches - Martin Alewijn (WFSR)

14.00 A Bayesian meta-data frame as a decision aid for photonic sensing in food intake - Hajo Rijgersberg and Hannelore Heuer (WFBR)

14.20 Break Till 14.40

Program (ii)

- Initiatives at WU and WR on food intake

14.40 Hyperspectral imaging for food recognition – Esther Kok (WU-HNE)

15.00 Photonic solutions for identifying food and its composition: examples from the Knowledge base 'Sensing potential' project – Meeke Ummels (WFBR)

15.20 Panel discussion – How to make WUR a world leader in food intake assessment?

15.45 Closure

Towards smart solutions for the universal assessment of food intake

Rationale for the study – Mireille Baart

WU – dept. of Human Nutrition

Importance of food intake assessment

Nutrition plays an important role in health and disease

Examples

- Energy dense, high fat diets: cardiovascular disease, diabetes
- Low fruit and vegetable intake, high red meat intake: cancer

Numerous associations and metabolic pathways still unknown

Importance of food intake assessment

Accurate assessment of food intake is important

- To investigate associations between nutrition and health / diseases
- To provide personal dietary advice (preventive / health improvement)

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Challenge of food intake assessment

Standard measurement: Questionnaires, interviews

Disadvantages

- Burdensome for patients / participants
- Recall bias
- Difficult to assess specific food types (nutrients) and exact amounts

Example FFQ: vegetables

Type and frequency of vegetables

39c Welke soorten gekookte of gewokte groente heeft u gegeten?

	zelden/nooit	soms	vaak	meestal/altijd
bloemkool en broccoli	O	O	O	O
koolsoorten (witte-, rode-, spits-, groene-, savooie-, chinese, boeren- en zuurkool en spruitjes)	O	O	O	O
spinazie	O	O	O	O
sperziebonen, snijbonen en tuinbonen	O	O	O	O
wortel	O	O	O	O
overige gekookte of gewokte groente	O	O	O	O

Amount of vegetables

39b Hoeveel opscheplepels gekookte of gewokte groente heeft u gemiddeld op zo'n dag gegeten?

1	2	3	4	5	6	7	8	9	10	11	12
O	O	O	O	O	O	O	O	O	O	O	O

Example FFQ: butter

Amount of butter on biscuit

3c Hoeveel boter, margarine en/of halvarine deed u meestal op een beschuit/knäckebröd?

| niet besmeerd	nauwelijks dekkend	dekkend	ruim dekkend	zeer ruim dekkend
o	o	o	o	o

Type of butter

3d Waarmee besmeerde u meestal de beschuit, knäckebröd enz.?

halvarine of light margarine	[ ]
dieethalvarine of dieetmargarine light	[ ]
halvarine met plantensterolen/stanolen	[ ]
laagvet halvarine product (25% vet of minder)	[ ]
margarine in kuipje	[ ]
margarine in pakje	[ ]
dieetmargarine	[ ]
roomboter	[ ]
halfvolle roomboter	[ ]
geen smeersel	[ ]

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Largest challenges

Vegetables
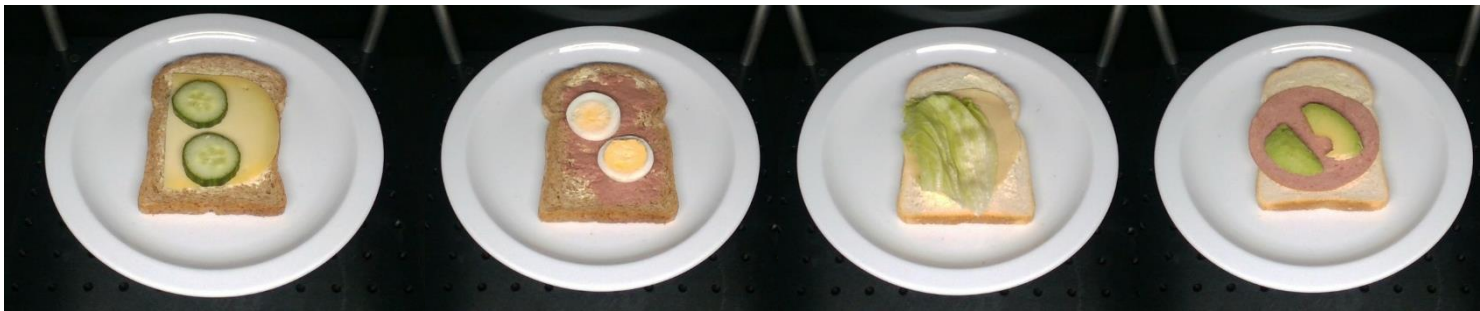
Bread type,

Butter type,

Toppings

Challenge of food intake assessment

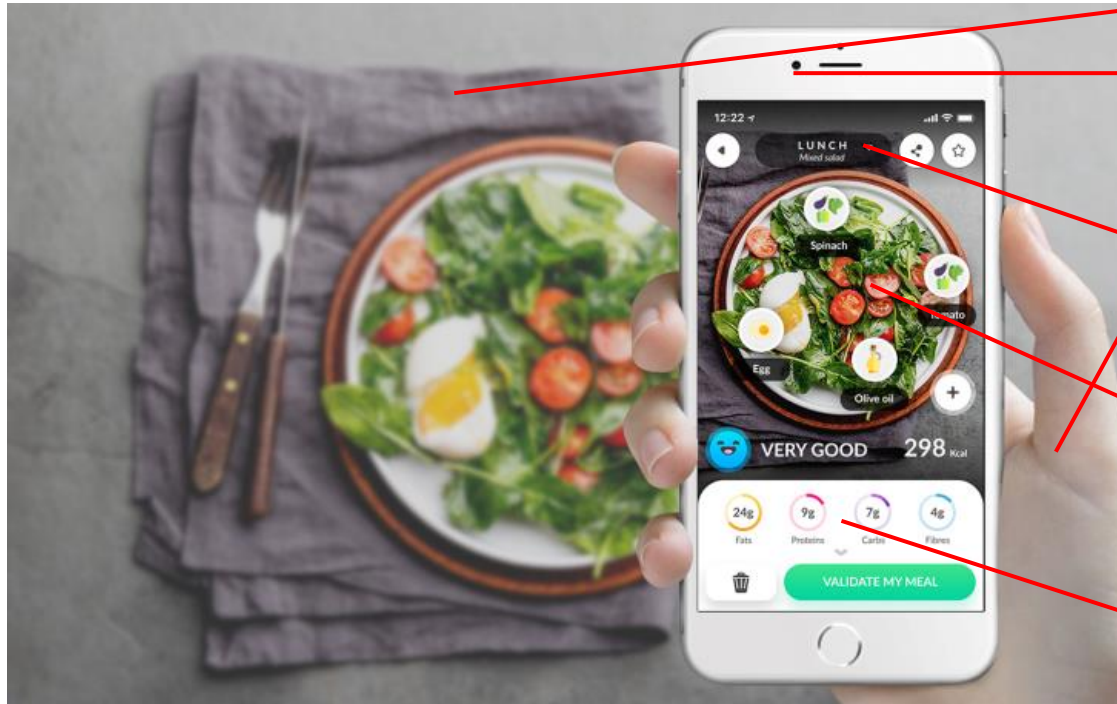Need to develop new measurement device to assess food intake

- Easy to use
- Accurate assessment of both food type and food amount

Technical perspective to photonics for food intake

Yannick Weesepoel, WFSR

The problem deconstructed

Lightening condition

Camera tech specifications

User variation

Vast variation in food
Meta-data incorporation

Product ID
Preparation method
Amount in grams
(Overlap food)

Product composition
Calibration nutrients
Layer thickness

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2. Composition information
IMEC Snapscan SWIR 1100 – 1700 nm
Hyperspectral Camera

3. Data Fusion (high-level)
Prediction accuracy - Versatility

4. Bayesian meta-data frame
Decision aid to increase accuracy

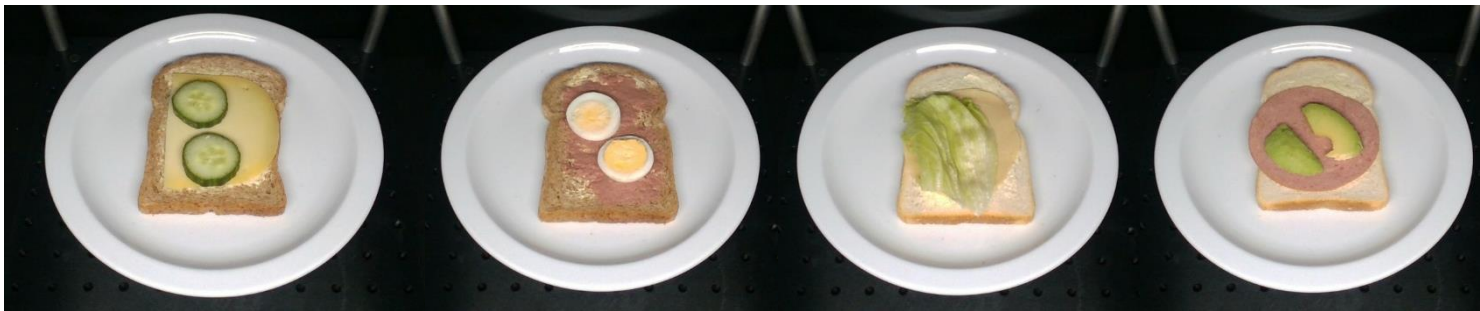**1. Volume estimation and object recognition**
Intel RealSense – RGBD

Cases studied in the NWA project

Vegetables

Bread type,

Butter type,

Toppings

Key innovations from NWA project

- RGB-D camera

  - ID of product and preparation

  - Weight estimation of individual products without gravimetry

- Hyperspectral imaging camera

  - General model nutrient composition for all products

  - Estimating layer tickness of butters and spreads

- Bayesian meta-data frame

  - Provide decision aid

  - Increase versatility of the setup

Key technical issues

- 2 illumination systems required (TL and halogen)

  - Translation to changing light conditions

- Static system

  - Translation to portable system

- Cost reduction

  - Current system 45 – 50 keuro

- Software layer to integrate decisions and operate both cameras