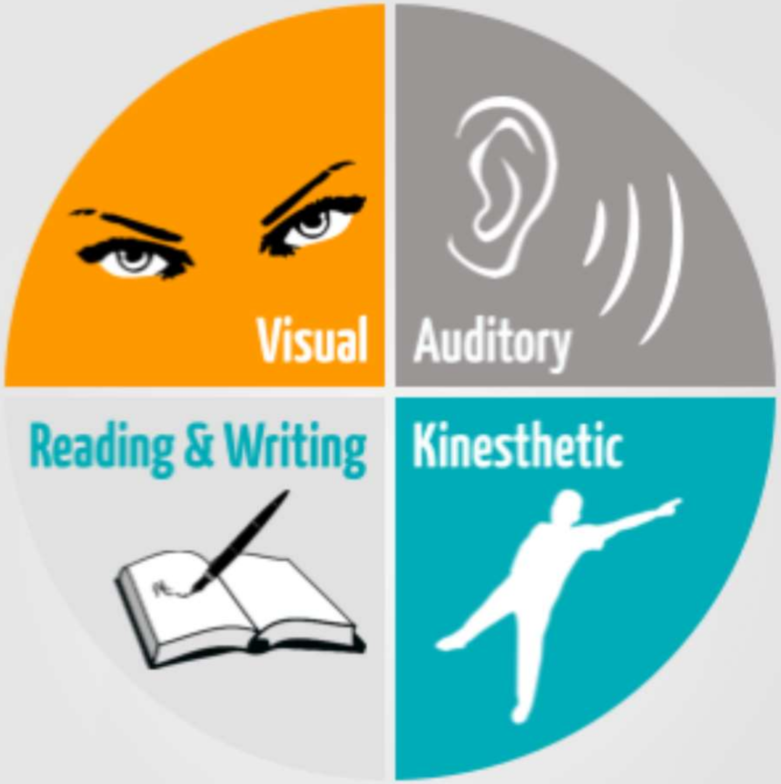
Multimodal learning for customs fraud detection & action recognition

Estimated duration : 4,30 min

Why we need Multimodal learning?

Our experience of the world is multimodal

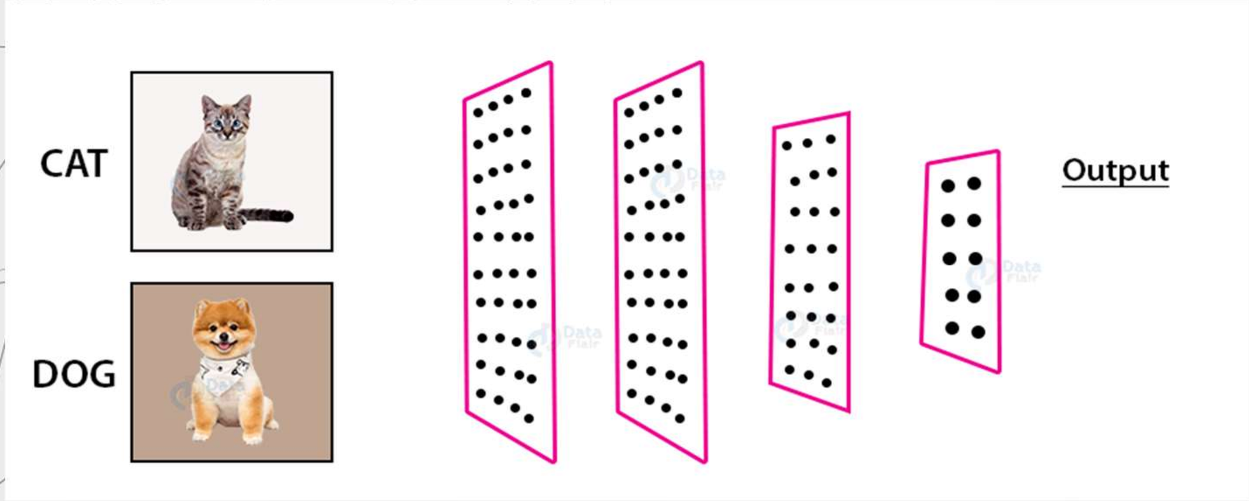
Multimodal learning suggests that when a number of our senses — visual, auditory, kinesthetic — are being engaged in the processing of information, we understand and remember more.



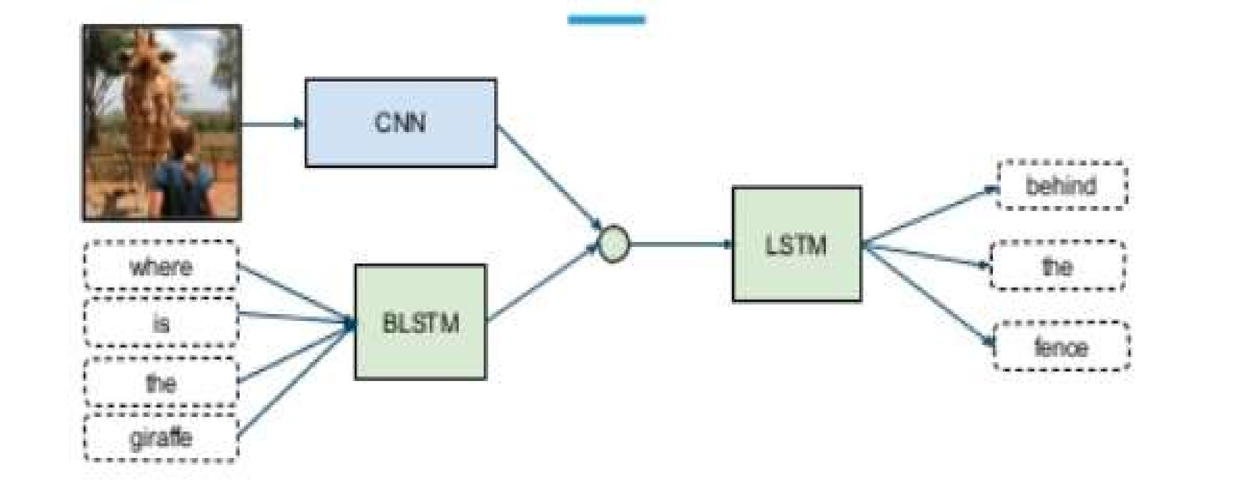
Then what is a modality and multimodal learning ?

Modality : It is a way or an environment in which something happened or is experienced , Examples : image, audio , text…etc.

Multimodal Learning : When multiple modalities are involved during training and inference phase , we call that a multimodal learning



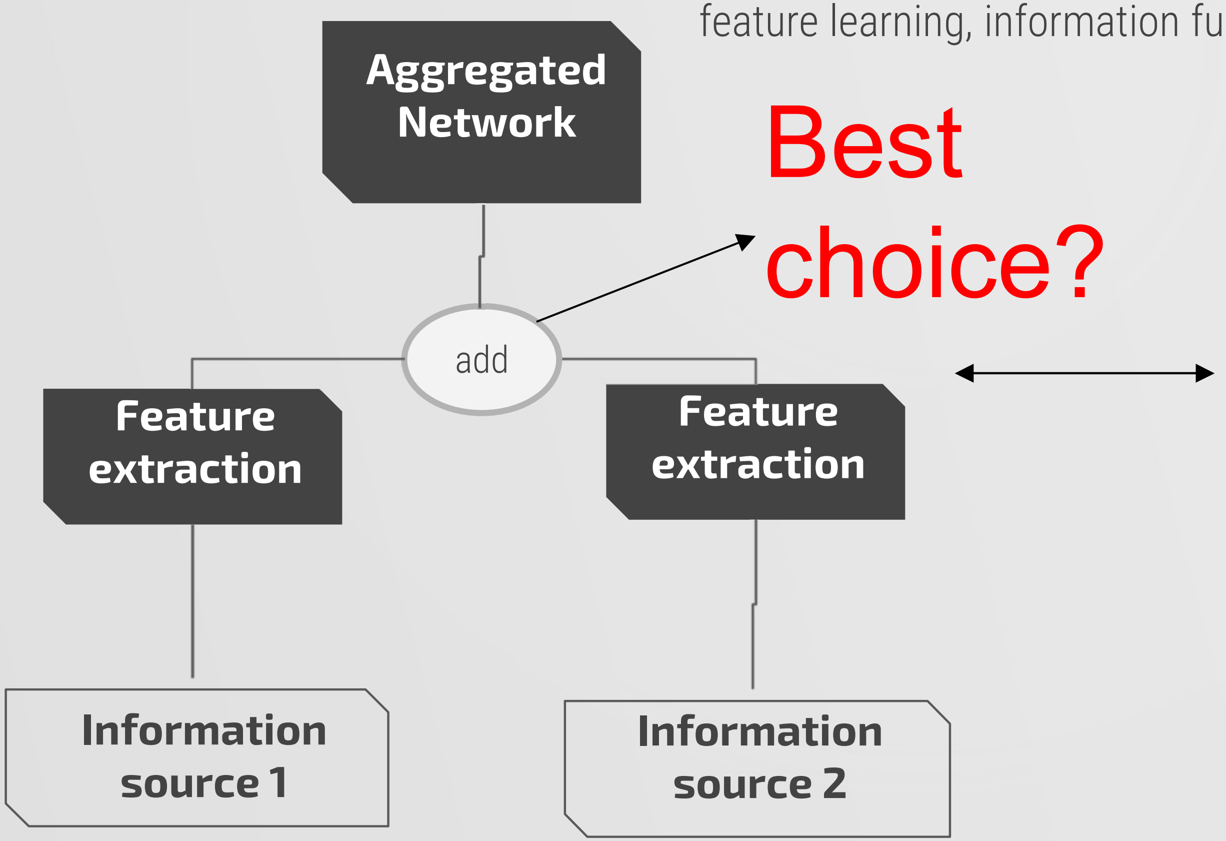
Unimodal learning



Multimodal learning

How do they work

In multimodal learning, as its name suggests, we aim to do information fusion from different modalities to improve our network's predictive ability. The overall task can mainly be divided into three phases – individual feature learning, information fusion and testing.



Aggregated Network

add

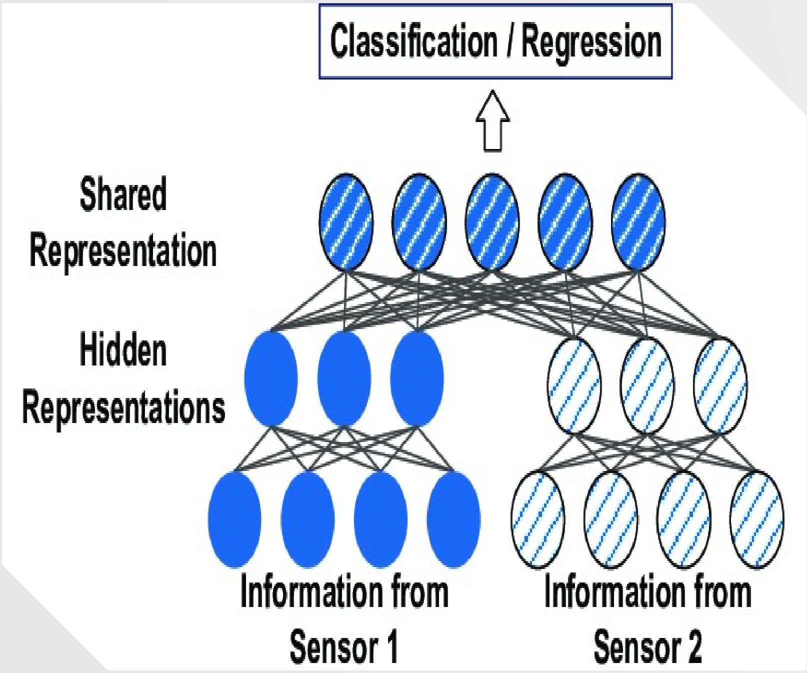
Best choice?

Feature extraction

Feature extraction

Information source 1

Information source 2


Classification / Regression
Shared Representation
Hidden Representations
Information from Sensor 1
Information from Sensor 2

Main thesis objectives

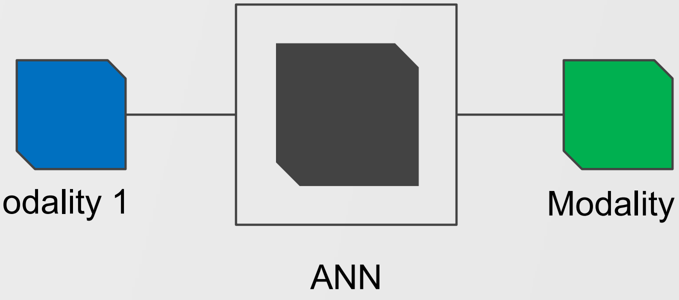
01 Determine the appropriate **algorithm that is able to cope with multimodal learning** in context of multimedia processing and medical imaging

02 Exploit the **provided multimodal datasets from our sponsors (E-origin and Infrabel)** to validate and solve real-world problems

03 Build a framework capable of explaining our model results

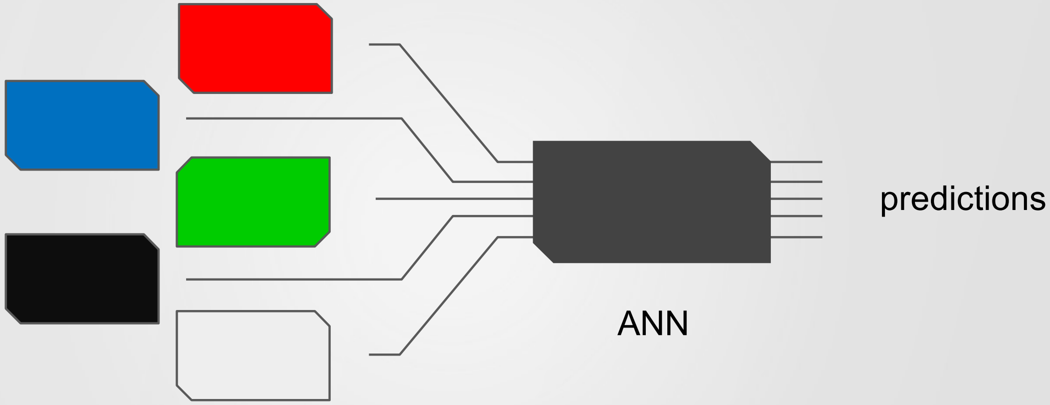
Multimodal Learning can be devided into two categories :

Modality to modality transition



Corresponding challenges are :
Transition and Alignement

Muti-modalities input



Corresponding challenges are :
Representation , Fusion

Use Cases

e-Origin

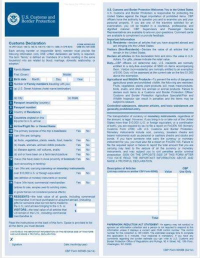
Customs fraud detection

Modalities

Images

For Plaster Wall
For Wooden, Brick, Concrete Wall
Anti-rust heavy-duty iron material
PVC material, protect your item from scratches and slip

Text (Customs déclarations , tarbel)



U.S. Customs and Border Protection

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Customs Declaration

19 CFR 122.27, 148.12, 148.13, 148.110, 148.111, 1498; 31 CFR 5316

FORM APPROVED OMB NO. 1651-0009

Each arriving traveler or responsible family member must provide the following information (only ONE written declaration per family is required). The term "family" is defined as "members of a family residing in the same household who are related by blood, marriage, domestic relationship, or adoption."

1 Family Name
First (Given) Middle
2 Birth date Month Day Year
3 Number of Family members traveling with you
4 (a) U.S. Street Address (hotel name/destination)
(b) City (c) State
5 Passport issued by (country)
6 Passport number
7 Country of Residence
8 Countries visited on this trip prior to U.S. arrival
9 Airline/Flight No. or Vessel Name
10 The primary purpose of this trip is business: Yes □ No □
11 I am (We are) bringing
(a) fruits, vegetables, plants, seeds, food, insects: Yes □ No □
(b) meats, animals, animal/wildlife products: Yes □ No □
(c) disease agents, cell cultures, snails: Yes □ No □
(d) soil or have been on a farm/ranch/pasture: Yes □ No □
12 I have (We have) been in close proximity of livestock: Yes □ No □
(such as touching or handling)
13 I am (We are) carrying currency or monetary instruments over $10,000 U.S. or foreign equivalent: Yes □ No □
(see definition of monetary instruments on reverse)
14 I have (We have) commercial merchandise: Yes □ No □
(articles for sale, samples used for soliciting orders, or goods that are not considered personal effects)
15 RESIDENTS—the total value of all goods, including commercial merchandise I/we have purchased or acquired abroad, (including gifts for someone else but not items mailed to the U.S.) and am/are bringing to the U.S. is: $
VISITORS—the total value of all articles that will remain in the U.S., including commercial merchandise is: $

Read the instructions on the back of this form. Space is provided to list all the items you must declare.

I HAVE READ THE IMPORTANT INFORMATION ON THE REVERSE SIDE OF THIS FORM AND HAVE MADE A TRUTHFUL DECLARATION.

X

Signature Date (month/day/year)

CBP Form 6059B (04/14)

U.S. Customs and Border Protection Welcomes You to the United States

U.S. Customs and Border Protection is responsible for protecting the United States against the illegal importation of prohibited items. CBP officers have the authority to question you and to examine you and your personal property. If you are one of the travelers selected for an examination, you will be treated in a courteous, professional, and dignified manner. CBP Supervisors and Passenger Service Representatives are available to answer your questions. Comment cards are available to compliment or provide feedback.

Important Information

U.S. Residents—declare all articles that you have acquired abroad and are bringing into the United States.

Visitors (Non-Residents)—Declare the value of all articles that will remain in the United States.

Declare all articles on this declaration form and show the value in U.S. dollars. For gifts, please indicate the retail value.

Duty—CBP officers will determine duty. U.S. residents are normally entitled to a duty-free exemption of $800 on items accompanying them. Visitors (non-residents) are normally entitled to an exemption of $100. Duty will be assessed at the current rate on the first $1,000 above the exemption.

Agricultural and Wildlife Products—To prevent the entry of dangerous agricultural pests and prohibited wildlife, the following are restricted: Fruits, vegetables, plants, plant products, soil, meat, meat products, birds, snails, and other live animals or animal products. Failure to declare such items to a Customs and Border Protection Officer/Customs and Border Protection Agriculture Specialist/Fish and Wildlife Inspector can result in penalties and the items may be subject to seizure.

Controlled substances, obscene articles, and toxic substances are generally prohibited entry.

The transportation of currency or **monetary instruments**, regardless of the amount, is legal. However, if you bring in to or take out of the United States more than $10,000 (U.S. or foreign equivalent, or a combination of both), you are required by law to file a report on FinCEN 105 (formerly Customs Form 4790) with U.S. Customs and Border Protection. Monetary instruments include coin, currency, travelers checks and bearer instruments such as personal or cashiers checks and stocks and bonds. If you have someone else carry the currency or monetary instrument for you, you must also file a report on FinCEN 105. Failure to file the required report or failure to report the total amount that you are carrying may lead to the seizure of all the currency or monetary instruments, and may subject you to civil penalties and/or criminal prosecution. SIGN ON THE OPPOSITE SIDE OF THIS FORM AFTER YOU HAVE READ THE IMPORTANT INFORMATION ABOVE AND MADE A TRUTHFUL DECLARATION.

Description of Articles (List may continue on another CBP Form 6059B)	Value	CBP Use Only
Total		

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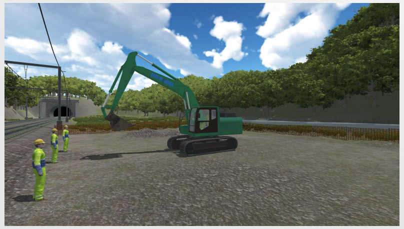
CBP Form 6059B (04/14)

INFRABEL

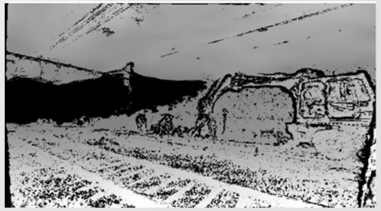
Construction Site Worker's safety using AI

Modalities

RGB Images



Depth maps

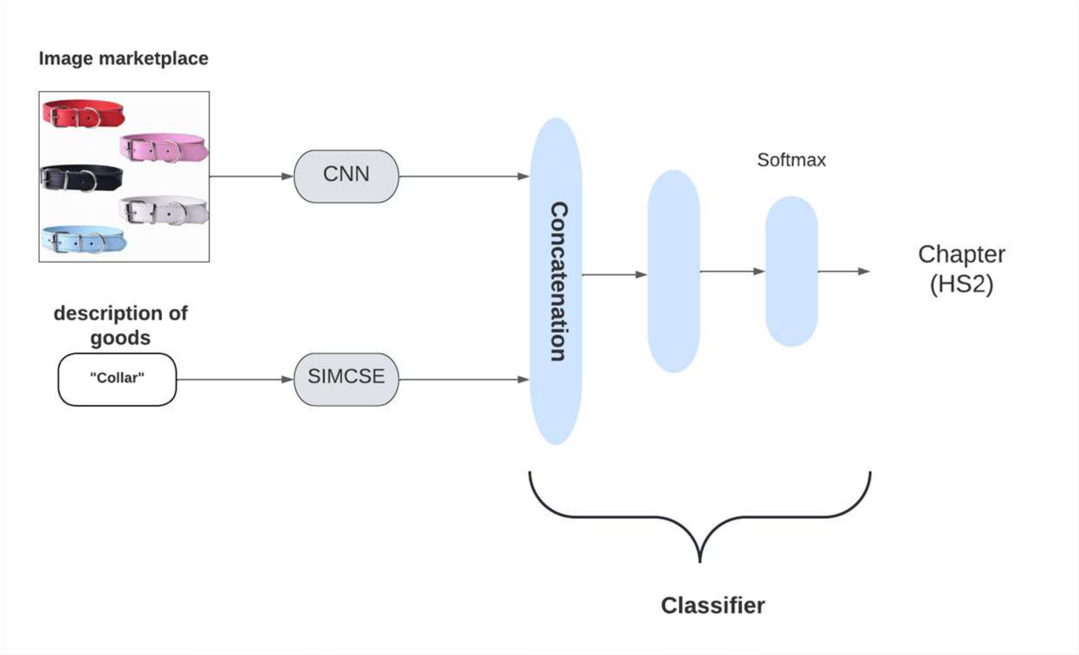


First results

e-Origin

Customs hs code prediction

Learning mode	accuracy
Text only (unimodal)	77.47 %
Image-text (multimodal)	83,51 %
Image-only (unimodal)	73,62 %



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