Artificial Intelligence and its Impact on the Industry

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University of Žilina

LuiZA Laboratory of Artificial Intelligence University of Žilina

KINIT

LUIZA & KINIT

Kempelen Institute of Intelligent Technologies

- Founded: 2020;
- Mission:
  - Improve SK's competitiveness;
  - Connect private & public sector;
  - Encourage responsible innovation, expansion of knowledge, talent cultivation; …

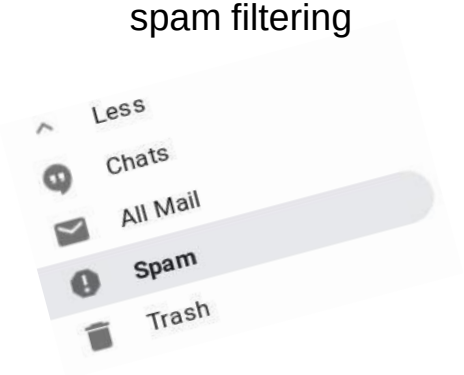
Laboratory of Artificial Intelligence of the University of Žilina

- Founded: April 11 2019;
- Mission:
  - Networking;
  - Original research in AI;
  - Education in AI;
  - Popularization;
  - …

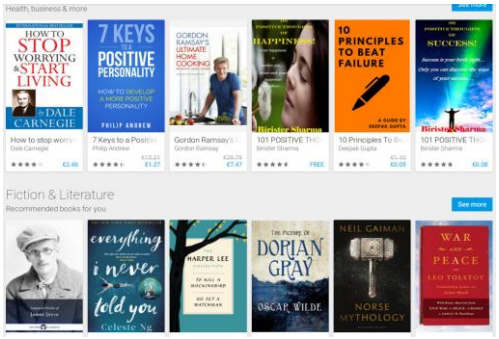
AI Methods Are Here

/ It's not just GPT: AI & ML methods are already ubiquitous

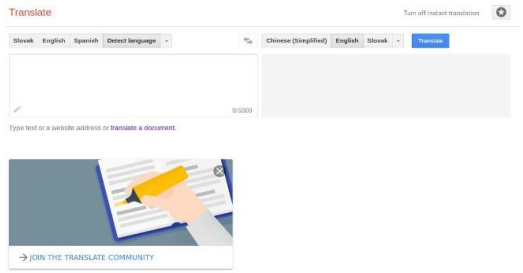
spam filtering

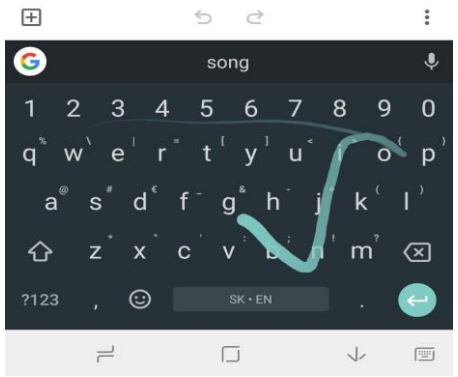


recommendation systems

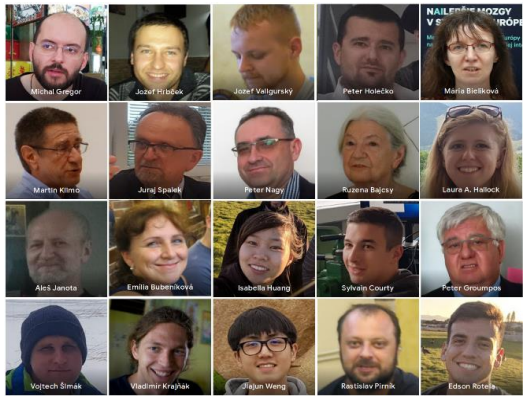


machine translation

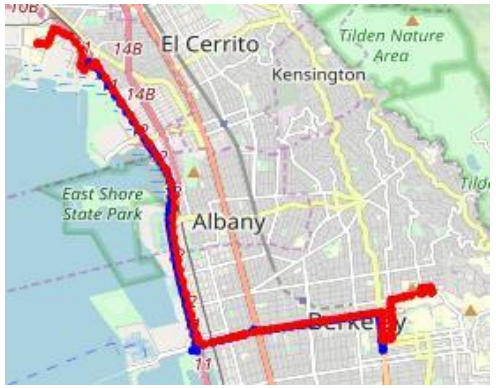




smart keyboards



face clustering & search



navigation, ride sharing, …

Big Implications for Perception & Control, …

[1]

[2]

[3]

Perception:

- Production line;
- In AGVs (obstacle, material recog., …);
- Localization & navigation;
- To increase safety (human recognition);
- …

Big Implications for Perception & Control, …

[1]

ETH, KAIST, Intel

[(6) Learning Quadrupedal Locomotion over Challenging Terrain - YouTube]

Deep Learning is Data-Hungry

- Millions of images + labels;
- Low-data tasks are very challenging;
  - Few-shot tasks;
  - Anomaly detection;
  - …

vs.

image sources: [1-4]

Adversarial Examples

jeep	0.95
minivan	2.47E-2
minibus	5.17E-3
pickup	3.92E-3
recreational vehicle	1.13E-3

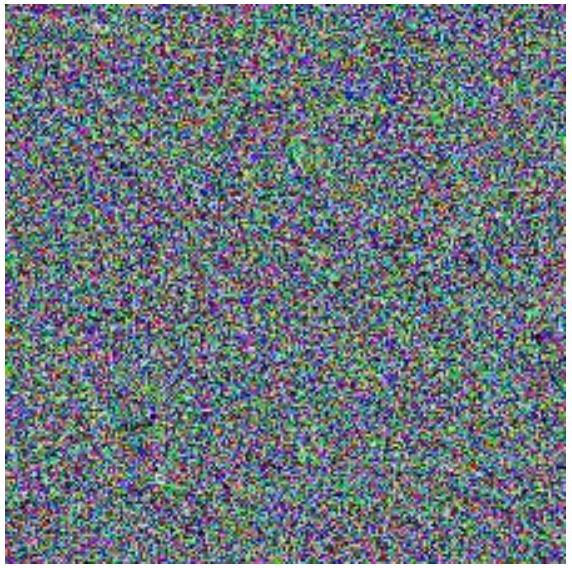
tank	0.95
jeep	2.59E-2
canon	3.54E-3
harvester	2.68E-3
projectile	2.60E-3

Adversarial Examples

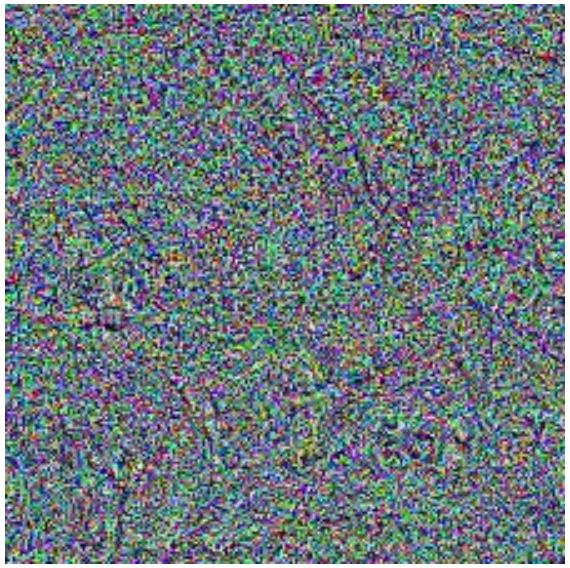
lion: 1.00

analog clock: 0.98

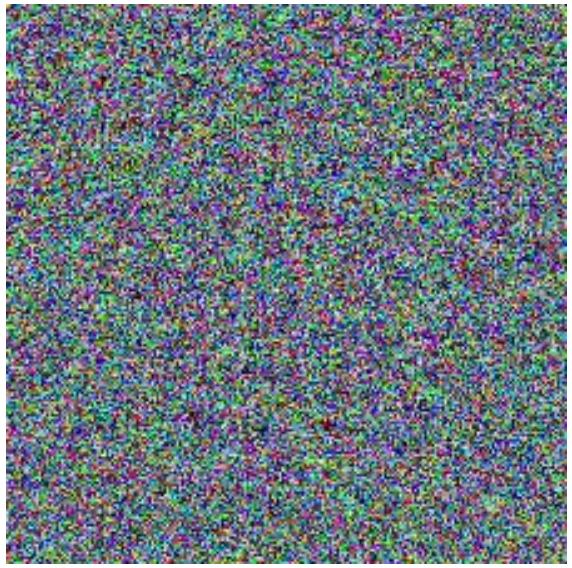
Adversarial Examples



analog clock	1.00
wall clock	2.47E-2
sundial	2.58E-5
digital clock	2.46E-5
odometer	1.99E-5

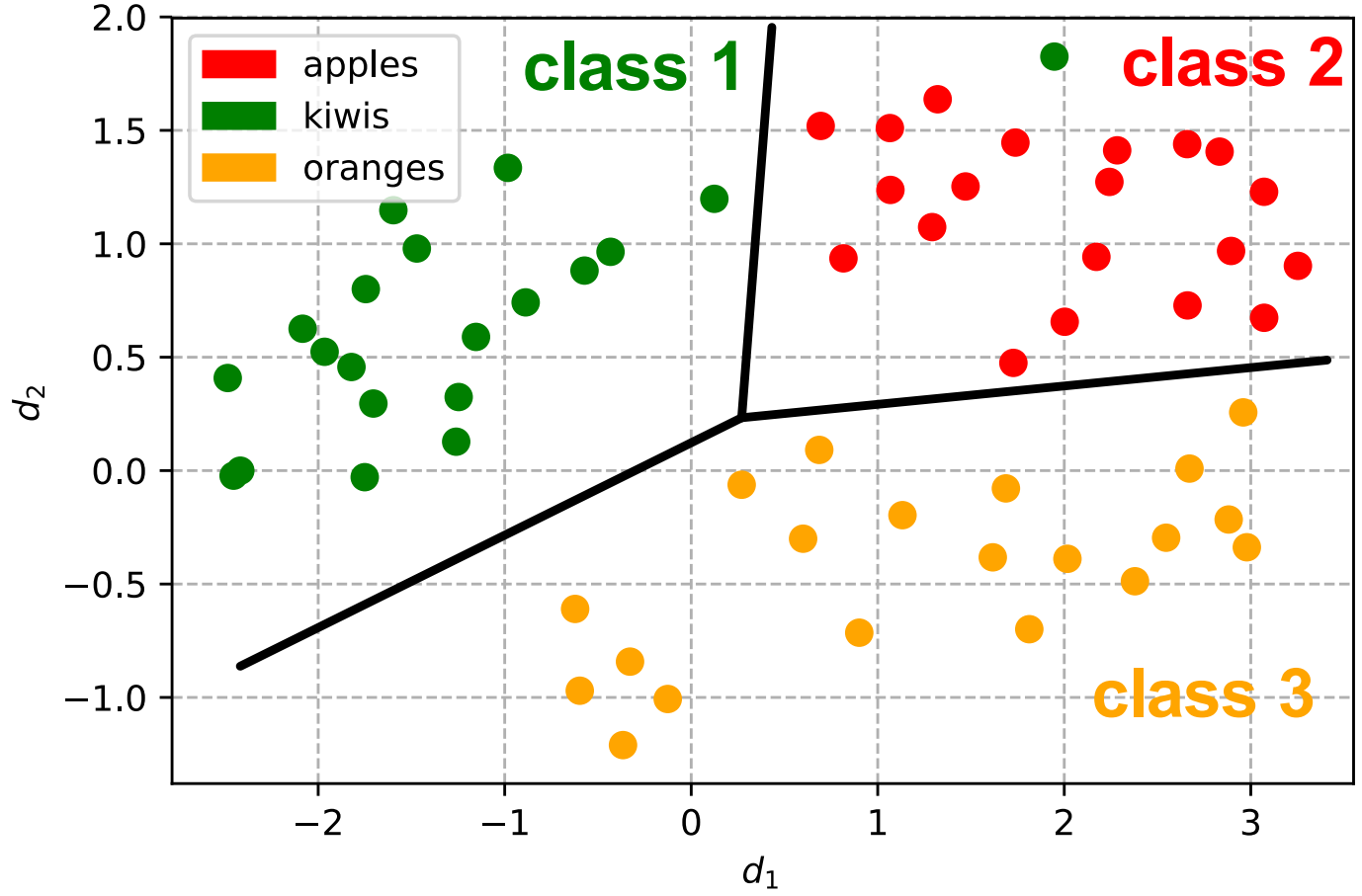


tank	1.00
half track	1.29E-4
canon	6.81E-5
steam locomotive	5.87E-5
bullfrog	4.61E-5



greenhouse	1.00
chainlink fence	8.54E-5
lawn mower	4.69E-5
picket fence	3.40E-5
umbrella	2.37E-5

Discriminative Models Are Limited



Generative Models to the Rescue?

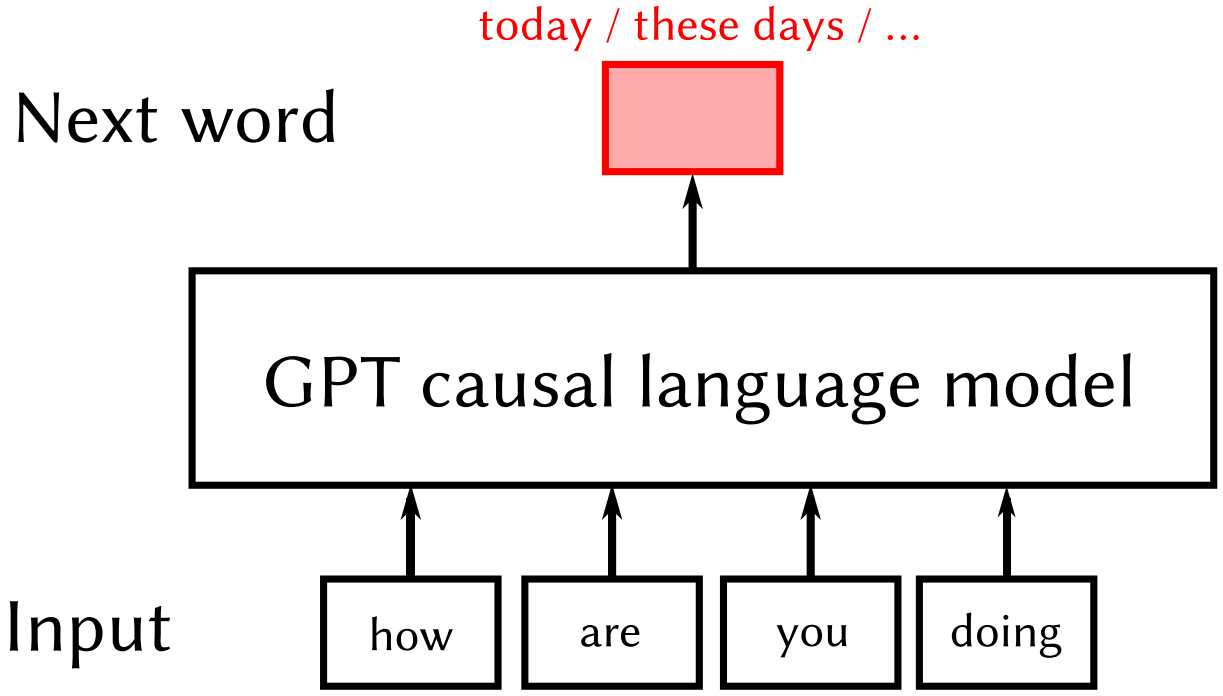
Generative Models Know What Images Look Like

Midjourney-generated image that won the Colorado State Fair Prize [1]

DALLE2-generated winner of a photography prize [2]

Generative Language Models (GPT et al.)

- Trained as “autocomplete over the internet”;
- Can be prompted efficiently for all kinds of tasks, e.g.:
  - The above text in polished scientific English;
  - [CONCEPT] explained to a 6-year old; …



GitHub Copilot

```python
# download the iris dataset and train a decision tree on it

import pandas as pd
from sklearn import tree
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score

# load the iris dataset
iris = load_iris()
X = iris.data
y = iris.target

# split the dataset into train and test
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)

# train a decision tree classifier
clf = tree.DecisionTreeClassifier()
clf = clf.fit(X_train, y_train)

# predict on the test set
y_pred = clf.predict(X_test)

# calculate the accuracy
accuracy = accuracy_score(y_test, y_pred)

# print the accuracy
print(accuracy)
```

✓ 0.0s Python

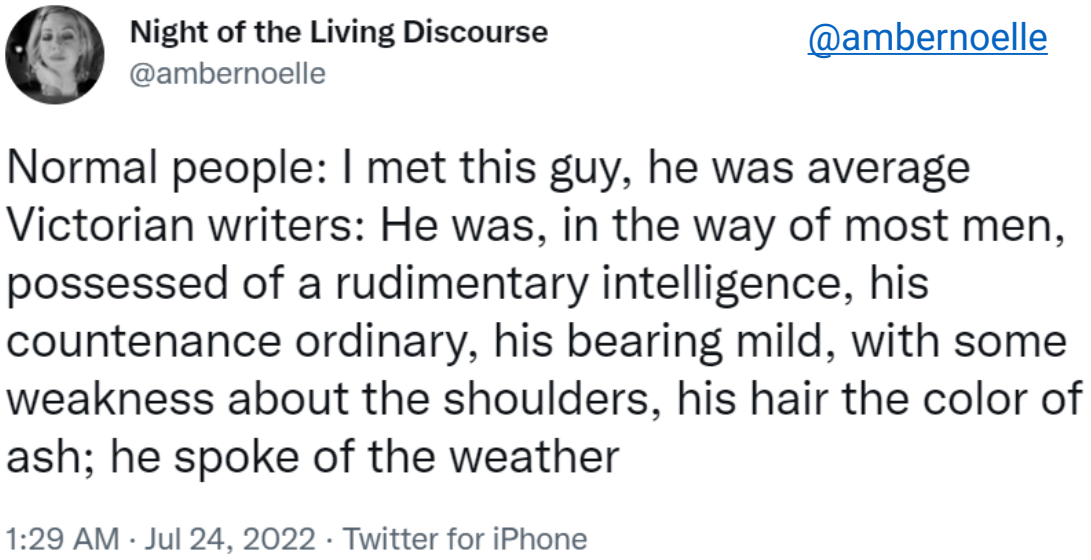
```
1.0
```

Be very cautious!!

- This learns from GitHub, i.e. **mixed code quality**;
- It also writes unsafe code, bugs, ... [1-4];
- Carefully check all generated code!

Few-Shot Prompting (Victorian Writers)

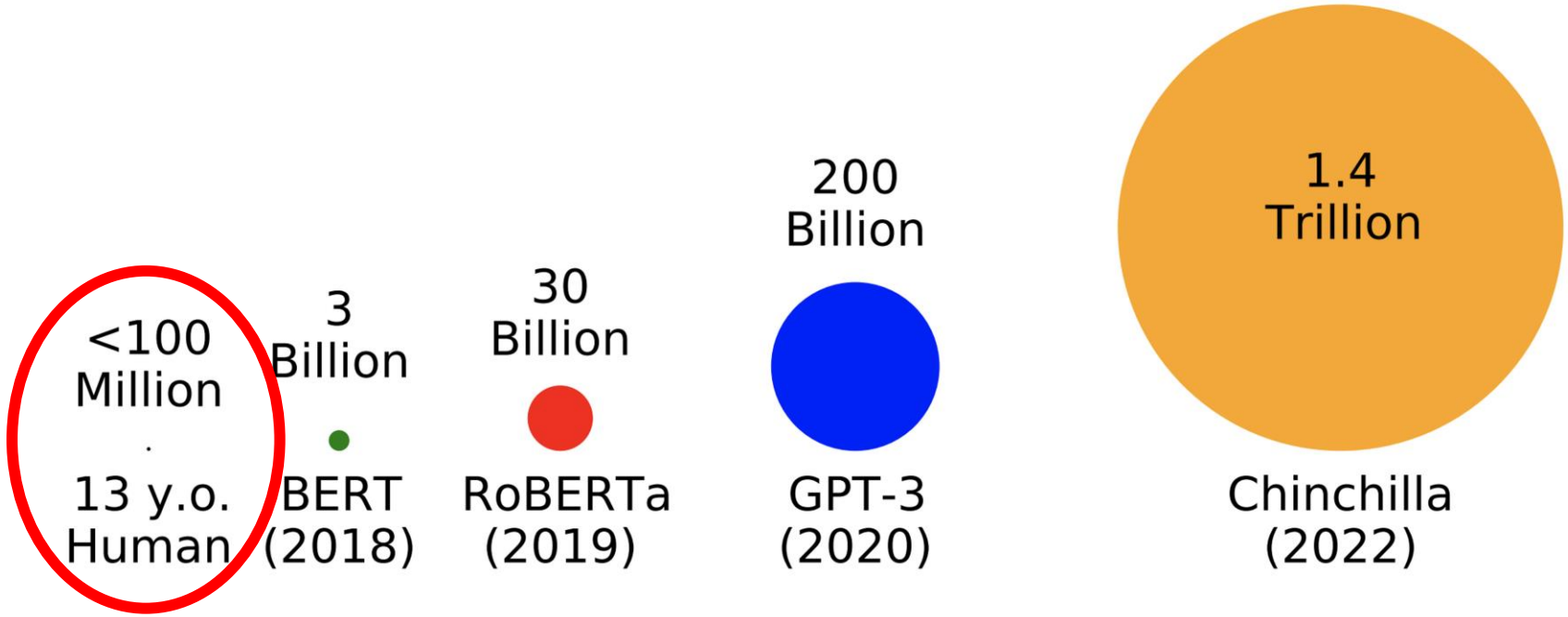
- Few-shot prompting: show the model a few examples;
  - To deal with very low-data tasks;



From GPT-3:

- **Prompt:** *"Normal people: I went out today and the weather was mild"*
- **Response:** *"Victorian writers: The day, though not unpleasing, was not of the first water, the sun struggling through a haze of cloud, the breeze fresh but not invigorating"*

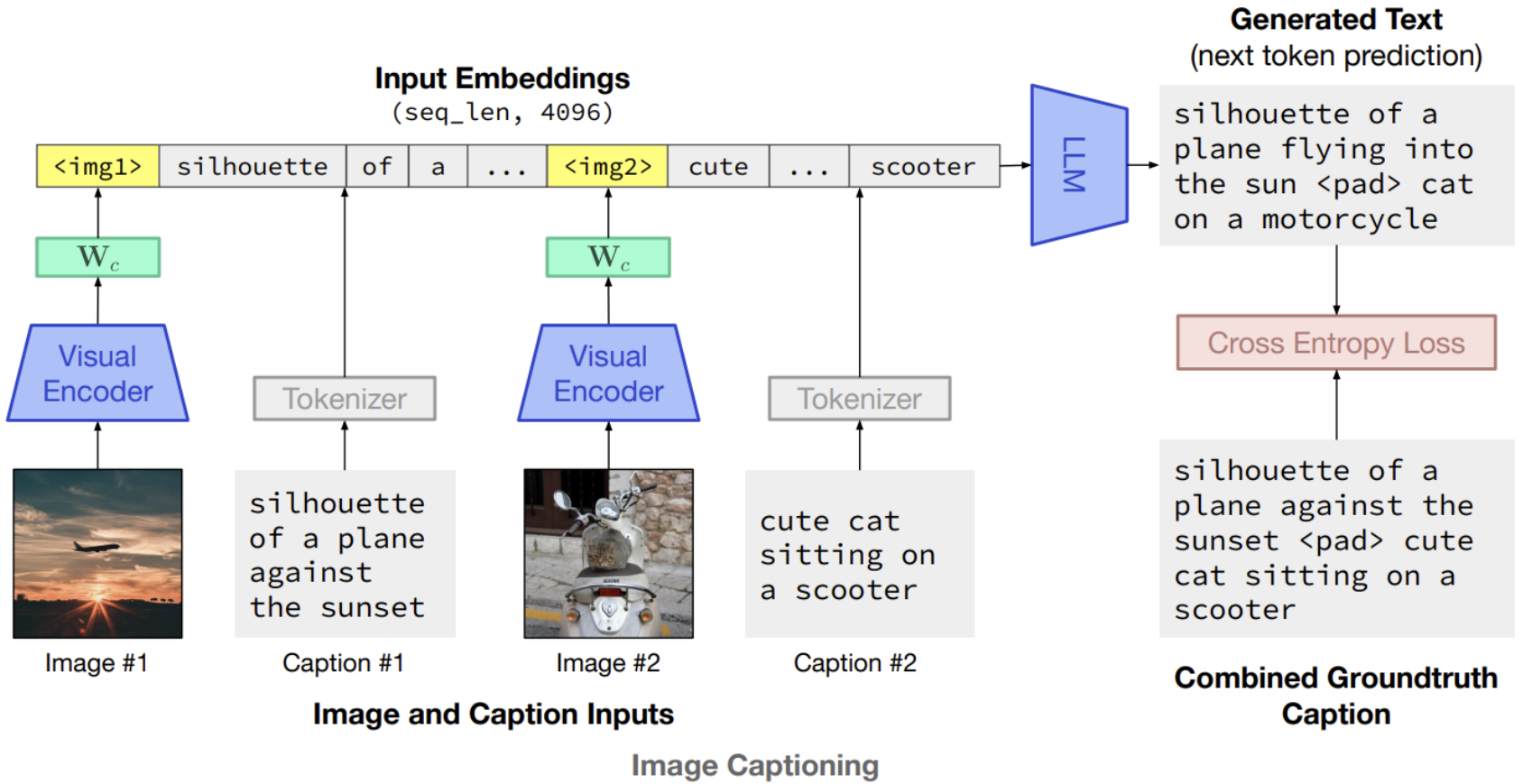
Deep Learning vs. Humans: Amount of Data



[1]

But humans are exposed to a continuous stream of multimodal data & they can take actions and observe their effects!

Multi-Modal Single-Sequence Models



[1]

Thank you for your attention!

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