APPLYING ADVANCED TECHNOLOGIES TO MEL

30th August 2022

Clear Horizon

APPLYING ADVANCED TECHNOLOGIES TO MEL

About

Why

What

Internet of Things

Natural Language Processing

Blockchain Technology

Clear Horizon

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Clear Horizon

Demystifying complex data and digital solutions

Digital and data equality

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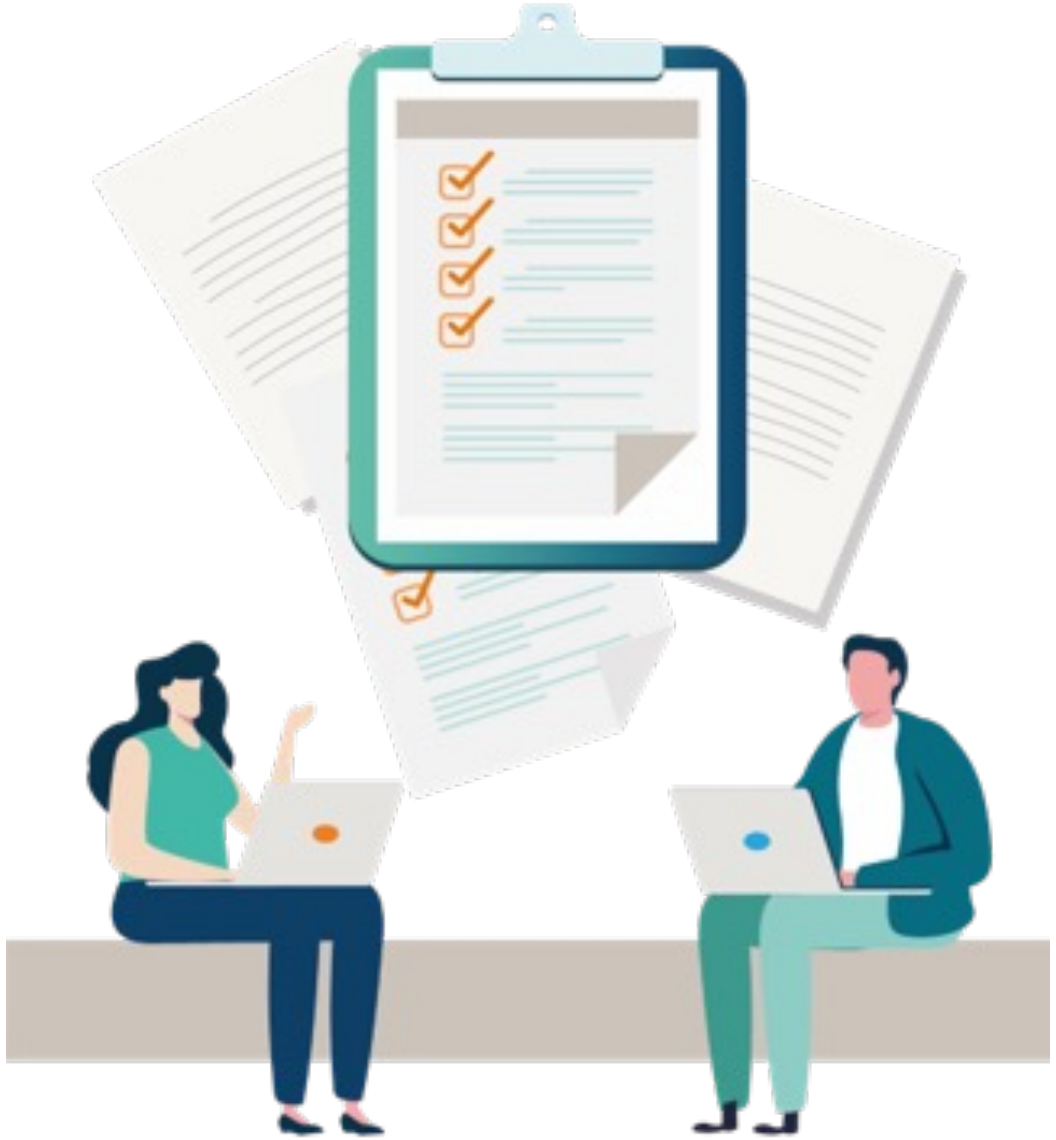
Efficiency and People

Increasing response rates

Minimising biases

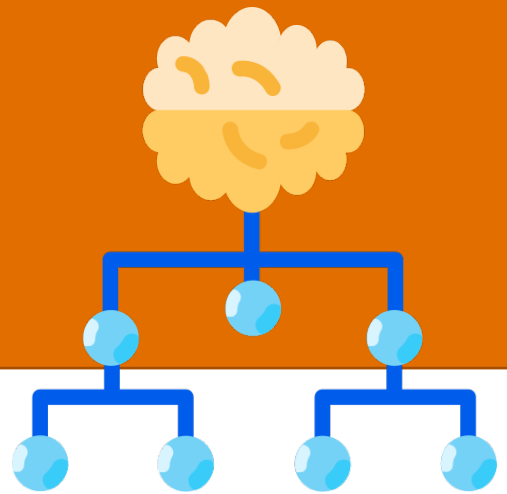
Improving the efficiency of data processes

Enhancing trust and ownership

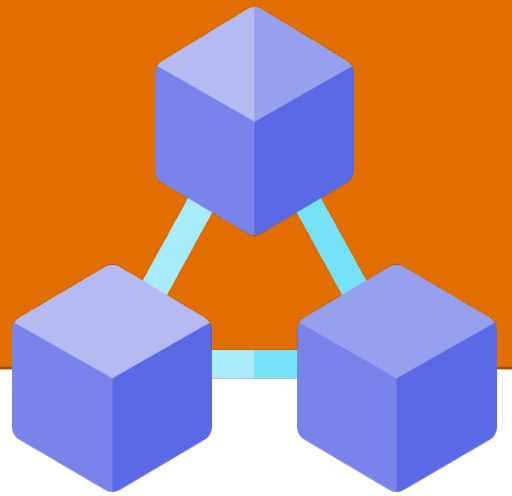


Internet of Things (IoT)

Natural Language Processing (NLP)



Blockchain Technology (BT)



11:34
Heart Rate
107 bpm
57 rhr
160
140
120
100
Low: 47
High: 171

Self-reported data

Activities and health report

- Response rate
- Hyper-active participants?

Health apps and smart watches

- No manual entries
- Unbiased activities
- Connected to existing account

HAPPY NOT

Access and anonymity

Collecting stories

- Time required for interviews
- Possible biased answer

IoT audio recorder

- No linked with an account
- More access to unbiased stories

Interviewer: What types of research did you do before when you were an associate professor?
Interviewee: I worked primarily with acoustics and noise control, with my emphasis being in active noise and vibration control. I worked with the aircraft fuselage and all of the vibrations and noises created in there and limiting their effects on the cockpit. Of course, automobile engines are also very noisy being so close to the driver. I also worked with compressors. I worked with really small compressors to really big compressors. I worked on small refrigeration units using passive and active control techniques. Youd be surprised at how big an issue refrigerator noise is overseas, in Europe and Asia with their tight living conditions. I also worked with huge engine compressors of up to sixty horsepower. Thats really big for a university, you know. I also worked with reciprocating compressors, screw compressors, scroll compressors, and rotary compressors.
Interviewer: Most of your current grants are education-related though, correct?
Interviewee: Thats right, most of them are related to education. But I dont have much time in this job now to do that though. I feel that I need to teach with this job, because I need to have that link to the curriculum and the students.
Interviewer: How much contact have you had with industry?
Interviewee: I had quite a bit of contact when I worked as an associate professor. I spent quite a bit of time at the Herrick Labs. I worked with a couple of United Technologies companies, Sikorkey Helicopter and Carrier Corporation, who does refrigeration, Aspera, which is an Italian company that makes compressors, General Motors, and some governmental work.
Interviewer: Did you ever work out in industry before you became a professor?
Interviewee: I worked at NASA-Langley for a year after I graduated with my masters. It really isnt like industry though. Its an academic environment. Its a very research-oriented environment. I also received an educational grant about a year ago to work the summer at Boeing. I worked in Philadelphia with the rotorcraft division. They make all levels of military aircraft. They make the Belle Boeing 609, which is a lot like a V-22. It takes off like a helicopter, straight up, and then the wings turn over and it flies. They also work on CH-47, which is a very old helicopter, in a support mode. They also do some work with the commanche attack helicopter. As you can tell, they work at a lot of different levels in the design.
Interviewer: What is the difference between designing for a new product versus an older product?
Interviewee: There are a lot of challenges no matter what the product. The military has been bringing old CH-47s in to be repaired. Boeing has been gutting them out, leaving just a shell, and completely replacing the interior equipment. All of the design used to be on paper. The new Boeing 777 was a paperless design. They did a fly-through on the computer to check for interferences and other problems. One of the big issues with the CH-47 was whether to recreate this on the computer. Its a difficult decision. It would make it a lot easier to make changes but it would take a lot longer. So they decided not to do it for this product.
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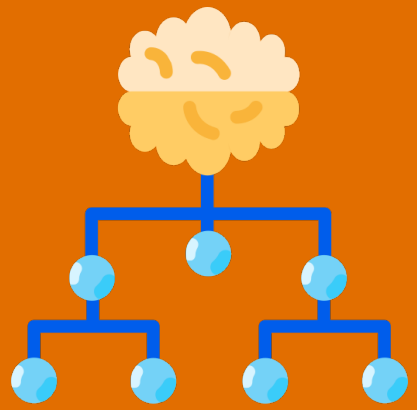


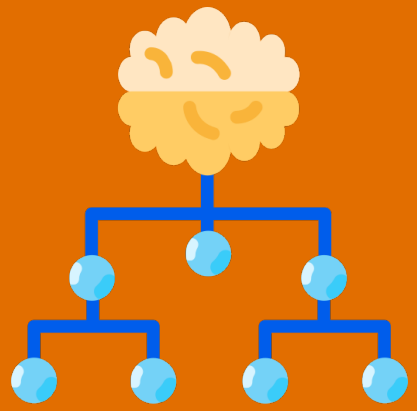
Time-consuming and bias

Extract key themes

- Time-consuming and costly
- Possible bias

Topic modelling

- Free open-source library to support the analysis



Processing time

Waiting time between data collection and analysis

- Slow iteration
- Possible bias

Real-time sentiment analysis

- Free open-source library to support the analysis

“I have a dream”, Martin Luther King Jr.
NLP script in < 30’

```
MLK_speech_token_1 = "Five score years ago, a great American, in whose symbolic shadow we stand today, signed the Emancipation Proclamati
MLK_speech_token_2 = "I have a dream that one day on the red hills of Georgia, the sons of former slaves and the sons of former slave own
MLK_speech_token_3  = "I have a dream that one day even the state of Mississippi, a state sweltering with the heat of injustice, swelteri
MLK_speech_token_4 =  "I have a dream that my four little children will one day live in a nation where they will not be judged by the col
MLK_speech_token_5 = "I have a dream that one day down in Alabama with its vicious racists, with its governor having his lips dripping wi
MLK_speech_token_6 = "I have a dream that one day every valley shall be exalted, every hill and mountain shall be made low, the rough pla
MLK_speech_token_7 = "This is our hope. This is the faith that I go back to the South with. With this faith, we will be able to hew out o

doc_complete = [MLK_speech_token_1,
                MLK_speech_token_2,
                MLK_speech_token_3,
                MLK_speech_token_4,
                MLK_speech_token_5,
                MLK_speech_token_6,
                MLK_speech_token_7]
```

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Preparing the text

```
#creating the words list

stop = set(stopwords.words('english'))
exclude = set(string.punctuation)
lemma = WordNetLemmatizer()
def clean(doc):
    stop_free = " ".join([i for i in doc.lower().split() if i not in stop])
    punc_free = ''.join(ch for ch in stop_free if ch not in exclude)
    normalized = " ".join(lemma.lemmatize(word) for word in punc_free.split())
    return normalized

doc_clean = [clean(doc).split() for doc in doc_complete]
```

Topic modelling

```
# Creating the term dictionary of our courpus, where every unique term is assigned an index.
dictionary = corpora.Dictionary(doc_clean)

# Converting list of documents (corpus) into Document Term Matrix using dictionary prepared above.
doc_term_matrix = [dictionary.doc2bow(doc) for doc in doc_clean]
```

```
# Creating the object for LDA model using gensim library
Lda = gensim.models.ldamodel.LdaModel

# Running and Trainign LDA model on the document term matrix.
ldamodel = Lda(doc_term_matrix, num_topics=5, id2word = dictionary, passes=50)
```

```
#topics
print(ldamodel.print_topics(num_topics=3, num_words=3))
```

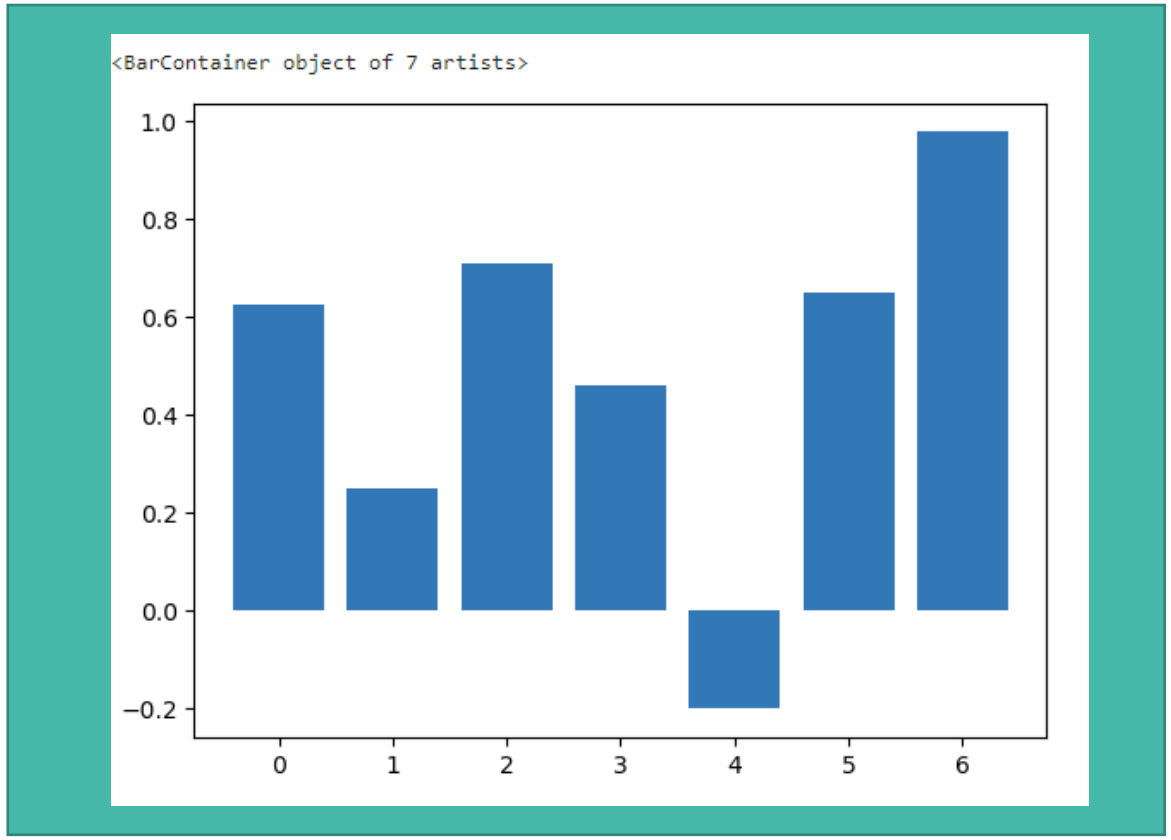
```
[(2, '0.034*"stand" + 0.034*"today" + 0.034*"symbolic"'), (4, '0.041*"one" + 0.041*"day" + 0.041*"dream"'), (0, '0.058*"together"
```

Sentiment analysis

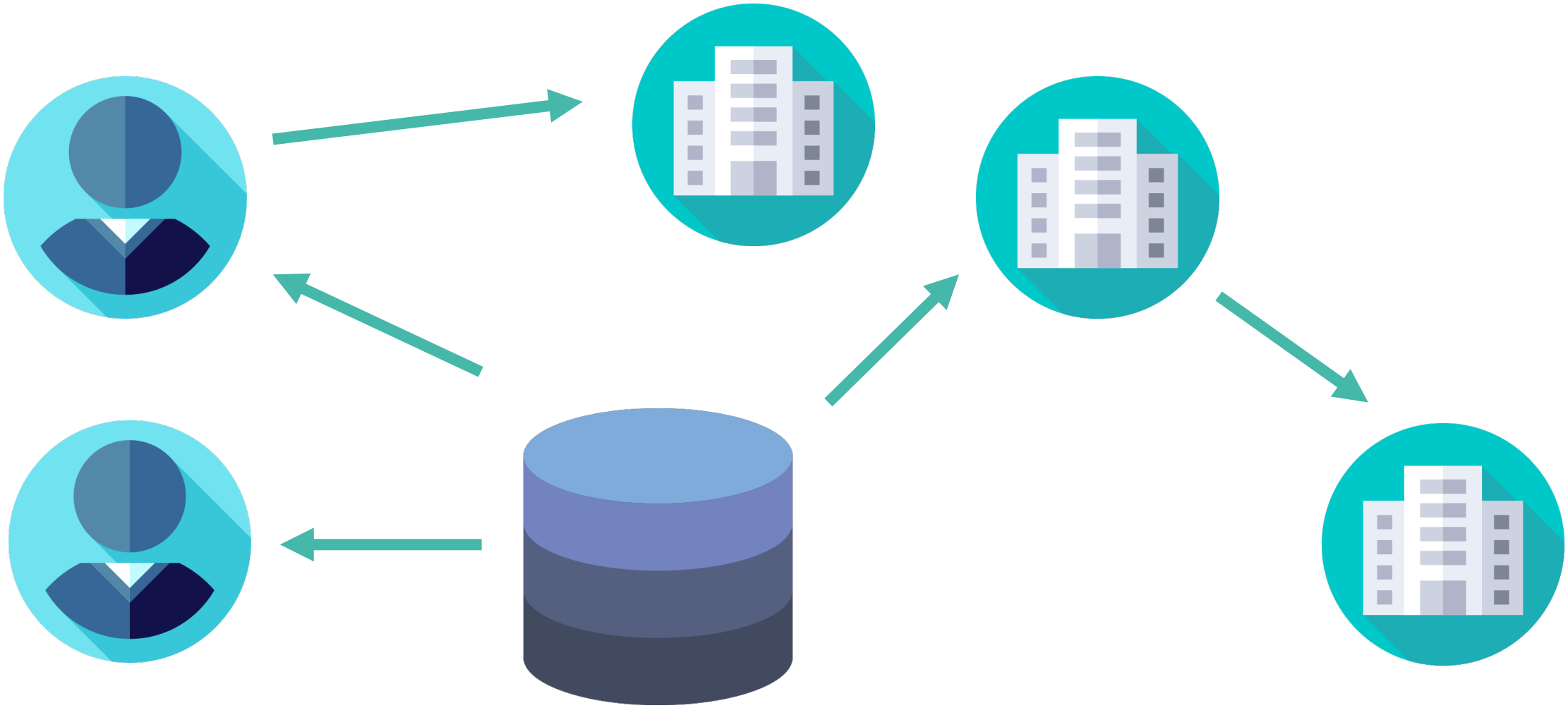
```
#sentiment analysis
sia = SentimentIntensityAnalyzer()

sentiments = [sia.polarity_scores(doc) for doc in doc_complete]

df = pd.DataFrame.from_dict(sentiments)
print(df)
```

```
     neg    neu    pos  compound
0  0.000  0.796  0.204    0.6249
1  0.000  0.944  0.056    0.2500
2  0.087  0.686  0.227    0.7096
3  0.000  0.892  0.108    0.4588
4  0.092  0.813  0.095   -0.2023
5  0.039  0.826  0.136    0.6486
6  0.041  0.683  0.276    0.9779
```

The narrative roller-coaster



About Why What IOT NLP **BT**



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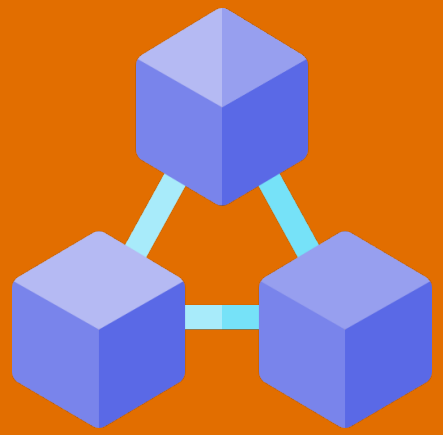

Lack of trust and ownership

Willingness to provide data affected by a lack of trust

- Impact the value of answers
- Empowering participants

Blockchain-based data collection tool

- No central entity access directly the data
- Answers automatically anonymised and participants can access their own data
- They can decide who access it and when

"You cannot discover new oceans unless you have the courage to lose sight of the shore".

Andre Gide

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THANK YOU

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