



EMET : EMBEDDINGS FROM MMULTILINGUAL- ENCODER TRANSFORMER FOR **FAKE NEWS** DETECTION

ICASSP May 04-08, 2020 Barcelona

Stephane Schwarz, Antônio Theóphilo, and Anderson Rocha

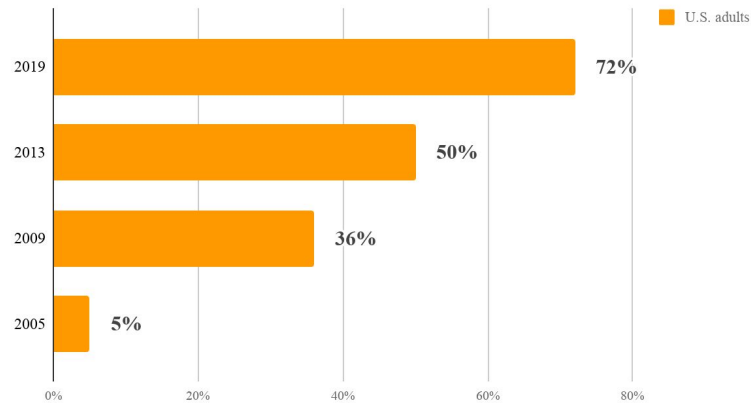
Institute of Computing, Unicamp, BR



Motivation

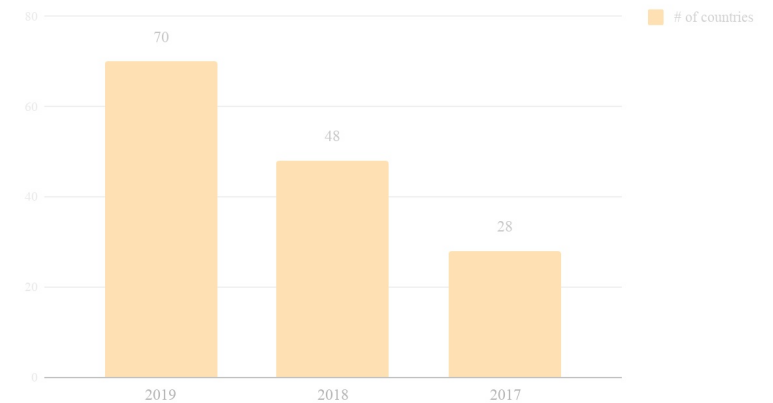


% of U.S. adults who use at least one social media site



Pew Research Center [1]

Social media manipulation campaigns

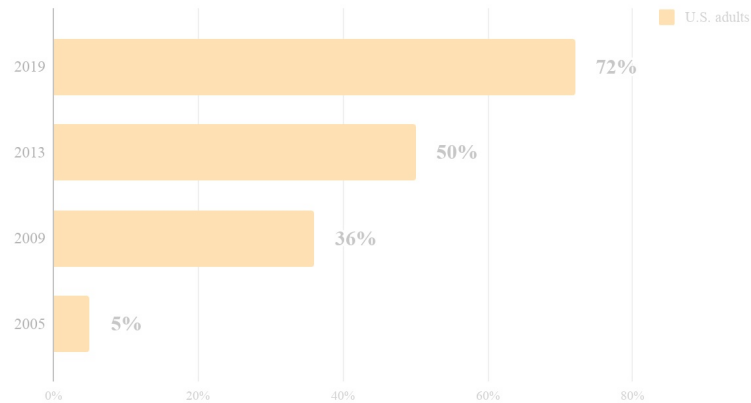


Oxford Internet Institute [2]

Motivation

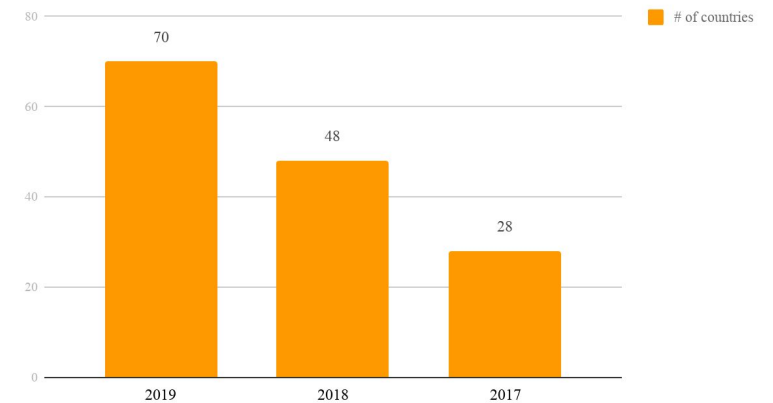


% of U.S. adults who use at least one social media site



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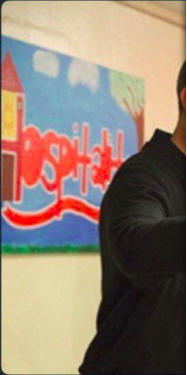
What is fake news?



↻ Aiden Benjamin

Aiden Benjamin
#SundayMo
#houstonflo

You will never
Obama serv



5

Gene Park @GenePark

This guy keeps reusing the same pic of Obama happening now.

It's fake, it's from Thanksgiving 2015, he's in [twitter.com/Feisal_Hagi/st...](https://twitter.com/Feisal_Hagi/status...)

Gene Park @GenePark

Look how desperate @feisal_hagi is attaching same fake news tweet and RTing himself, pinn gross. pic.twitter.com/pW5YB4xtfE


2:23 PM - Aug 27, 2017



33 25 people are talking about this

Will Brasington @WillBrasington

Obama tells marines they don't have to guard the Tomb of the Unknown Soldier due to Hurricane Sandy, they refuse. #usa



1:39 AM - 30 de out de 2012 - Twitter for iOS

529 Retweets 276 Curtidas

Katie @K_forKate - 30 de out de 2012
Em resposta a @WillBrasington @WillBrasington how the heck did

Will Brasington @WillBrasington
@K_forKate ima boss

Ross Fennell @RossFennell - 3 de out de 2012
Em resposta a @WillBrasington @WillBrasington 704 retweets, th



Jason Michael @Jeggit

Believe it or not, this is a shark on the freeway in Houston, Texas. #HurricaneHarvy

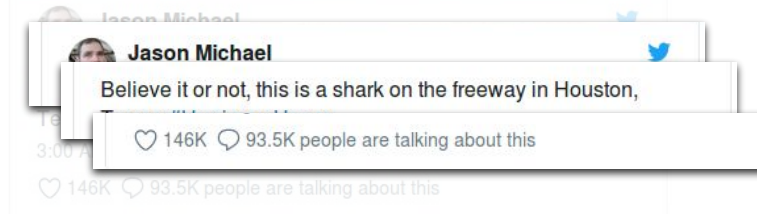
3:00 AM - Aug 28, 2017

146K 93.5K people are talking about this

Prior Art: Heuristic-based



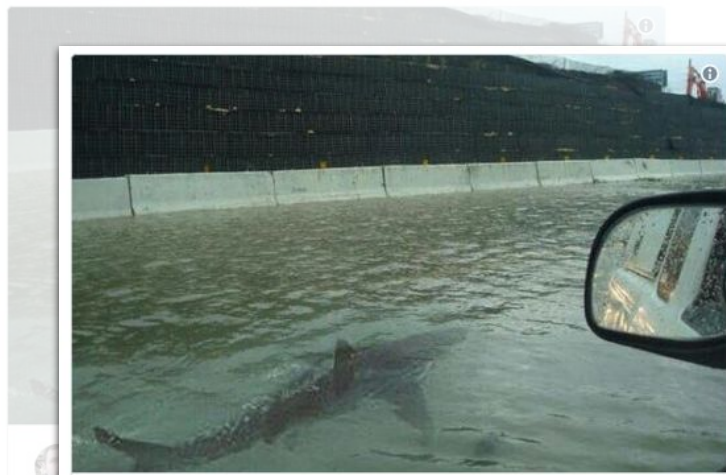
Caslillo et al. [3], Theóphilo et al.[5]



Prior Art: Multi-domain



Qi et al. [4]



Believe it or not, this is a shark on the freeway in Houston,

Texas. #HurricaneHarvy

3:00 AM

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EMET: Our hypothesis



Jesus words: “Then you will know the truth, and the truth will set you free.”

John 8 : 32

Jason Michael @Jeggit · Aug 28, 2017
Believe it or not, this is a shark on the freeway in Houston, Texas. #HurricaneHarvy

Reut Amit @reutamit · Aug 28, 2017
When reality is absurd, common sense and normality no longer work as filters. Can't blame people for not knowing what to believe anymore.

Jason Michael @Jeggit · Aug 28, 2017
That was the point of the tweet.

Hurricane Harvey: Texas braces for massive storm

© 25 August 2017

Hurricane Harvey: Texas governor warns bill could be \$180bn

© 3 September 2017

Hurricane Harvey heads towards Texas coast -NHC

1 MIN READ

Aug 24 (Reuters) - Hurricane Harvey was heading toward Texas, with devastating, life-threatening flooding expected near the coast because of heavy rainfall and storm surge, the U.S. National Hurricane Center said in its latest update on Thursday.

The center of Harvey was about 300 miles (480 km) south-southeast of Port O'Connor, Texas, and was packing maximum sustained winds of 85 mph (140 kph), the NHC said in its 2:00 GMT update.

Harvey will approach the middle Texas coast on Friday and make landfall on Friday night or early Saturday, the NHC added.

Nick Miller has the forecast for Texas as

Texas Governor Greg Abbott says the damage was devastated New Orleans

Meanwhile, the head of that food-hit states shod

Brock Long said Harvey

Recovery operations are under way across Texas, and in neighbouring Louisiana, although many areas are still battling floodwater.

National Hurricane Center said storm surges may bring life-threatening floods in and Houston.

EMET: Problem statement



T_i^E



Jason Michael
@Jeggit



Believe it or not, this is a shark on the freeway in Houston, Texas. [#HurricaneHarvy](#)

3:00 AM - Aug 28, 2017

♡ 146K 💬 93.5K people are talking about this

$$\mathcal{F} : (T_i^E \cdot C(T_i^E) \cdot N^E) \implies y$$

EMET: Problem statement



T_i^E



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$C(T_i^E)$

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Hurricane Harvey: Texas braces for massive storm

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3 September 2017



N^E



ENERGY AUGUST 24, 2017 / 6:15 PM / 3 YEARS AGO

Hurricane Harvey heads towards Texas coast -NHC

1 MIN READ



Texas is bracing itself to hit the US mainland

Harvey, currently a category 4 hurricane, is expected to make landfall on Texas' central coast.

The National Hurricane Center said in its latest update on Thursday.

Some residents have been advised to evacuate.

Texas Governor Greg Abbott said the damage was expected to be devastating.

Meanwhile, the head of the Texas National Guard said that flood-hit states should be prepared for a major relief effort.

Brock Long said Harvey should be expected to hit the Texas coast on Friday.

Recovery operations are under way in several areas, although many areas are still without power.

Aug 24 (Reuters) - Hurricane Harvey was heading toward Texas, with devastating, life-threatening flooding expected near the coast because of heavy rainfall and storm surge, the U.S. National Hurricane Center said in its latest update on Thursday.

The center of Harvey was about 300 miles (480 km) south-southeast of Port O'Connor, Texas, and was packing maximum sustained winds of 85 mph (140 kph), the NHC said in its 2100 GMT update.

Harvey will approach the middle Texas coast on Friday and make landfall on Friday night or early Saturday, the NHC added.

$$\mathcal{F} : (T_i^E \cdot C(T_i^E) \cdot N^E) \implies y$$

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3 September 2017



N^E

Hurricane Harvey heads towards Texas coast -NHC

1 MIN READ



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Harvey, currently a category 1 hurricane, is expected to make landfall on Texas' central coast and around Houston.

The National Hurricane Center said in its latest update on Thursday.

Aug 24 (Reuters) - Hurricane Harvey was heading toward Texas, with devastating, life-threatening flooding expected near the coast because of heavy rainfall and storm surge, the U.S. National Hurricane Center said in its latest update on Thursday.

Texas Governor Greg Abbott said in a tweet that the state is bracing for the worst.

He said the damage was worse than what was seen in New Orleans in 2005.

Meanwhile, the head of the Texas National Guard said that flood-hit states should be prepared for a long recovery.

Brock Long said Harvey should be expected to hit the Texas coast on Friday.

Recovery operations are under way in some areas, but it is unclear how long it will take to get things back to normal.

The center of Harvey was about 300 miles (480 km) south-southeast of Port O'Connor, Texas, and was packing maximum sustained winds of 85 mph (140 kph), the NHC said in its 2100 GMT update.

Harvey will approach the middle Texas coast on Friday and make landfall on Friday night or early Saturday, the NHC added.

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🕒 3 September 2017



N^E



ENERGY AUGUST 24, 2017 / 6:15 PM / 3 YEARS AGO

Hurricane Harvey heads towards Texas coast -NHC

1 MIN READ



Texas is bracing itself to hit the US mainland

Harvey, currently a category 4 storm, is expected to make landfall on Texas' central coast and around Houston.

The National Hurricane Center said it expects the storm to hit the Texas coast on Friday and make landfall on Friday night or early Saturday, the NHC added.

Aug 24 (Reuters) - Hurricane Harvey was heading toward Texas, with devastating, life-threatening flooding expected near the coast because of heavy rainfall and storm surge, the U.S. National Hurricane Center said in its latest update on Thursday.

The center of Harvey was about 300 miles (480 km) south-southeast of Port O'Connor, Texas, and was packing maximum sustained winds of 85 mph (140 kph), the NHC said in its 2100 GMT update.

Meanwhile, the head of the first flood-hit states should be recovering. Recovery operations are under way in several states, although many areas are still in need of aid. Harvey will approach the middle Texas coast on Friday and make landfall on Friday night or early Saturday, the NHC added.


$$\mathcal{F} : (T_i^E \cdot C(T_i^E) \cdot N^E) \implies y$$

EMET: Dataset



Hurricane Harvey: Texas braces for massive storm

© 25 August 2017



Nick Miller has the forecast for Texas as Harvey hits

Texas is bracing itself for Hurricane Harvey, which may be the worst storm to hit the US mainland in 12 years.

Harvey, currently a category two storm in the Gulf of Mexico, is expected to make landfall on Texas' central coast late on Friday or early Saturday.

The National Hurricane Center said storm surges may bring life-threatening floods in and around Houston.

Jason Michael
@Jeggit


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Hurricane Harvey: Texas governor warns bill could be \$180bn

© 3 September 2017



Some residents have been allowed to return to their homes to try to clean up after the hurricane

Texas Governor Greg Abbott has said the bill for reconstruction after Hurricane Harvey could be as high as \$180bn (£130bn).

He said the damage was worse than that caused by Hurricane Katrina, which devastated New Orleans in 2005.

Kavanaugh, the head of the government's disaster management agency has warned that flood-hit states should not rely on Washington to pick up the bill.

Brook Long said Harvey should be a wake-up call for local officials.

Recovery operations are under way across Texas, and in neighbouring Louisiana, although many areas are still battling floodwater.

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Training News was obtained from BBC and for Test set from Reuters.

EMET: Dataset



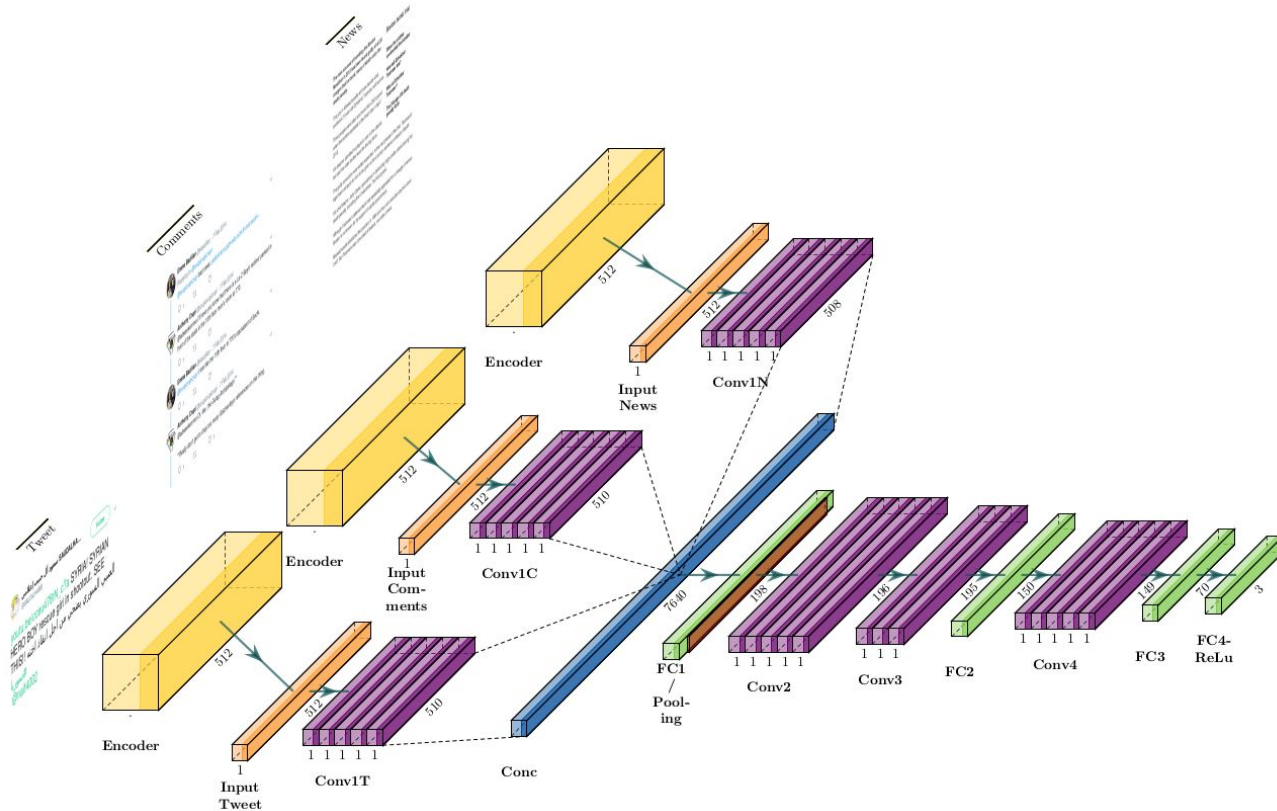
Class	Train	Test	Augmen. Train	Augmen. test
Real	4314	2200	9304	22000
Fake	6690	3732	23026	36262
Unknown	1416	600	2361	600

EMET: Dataset

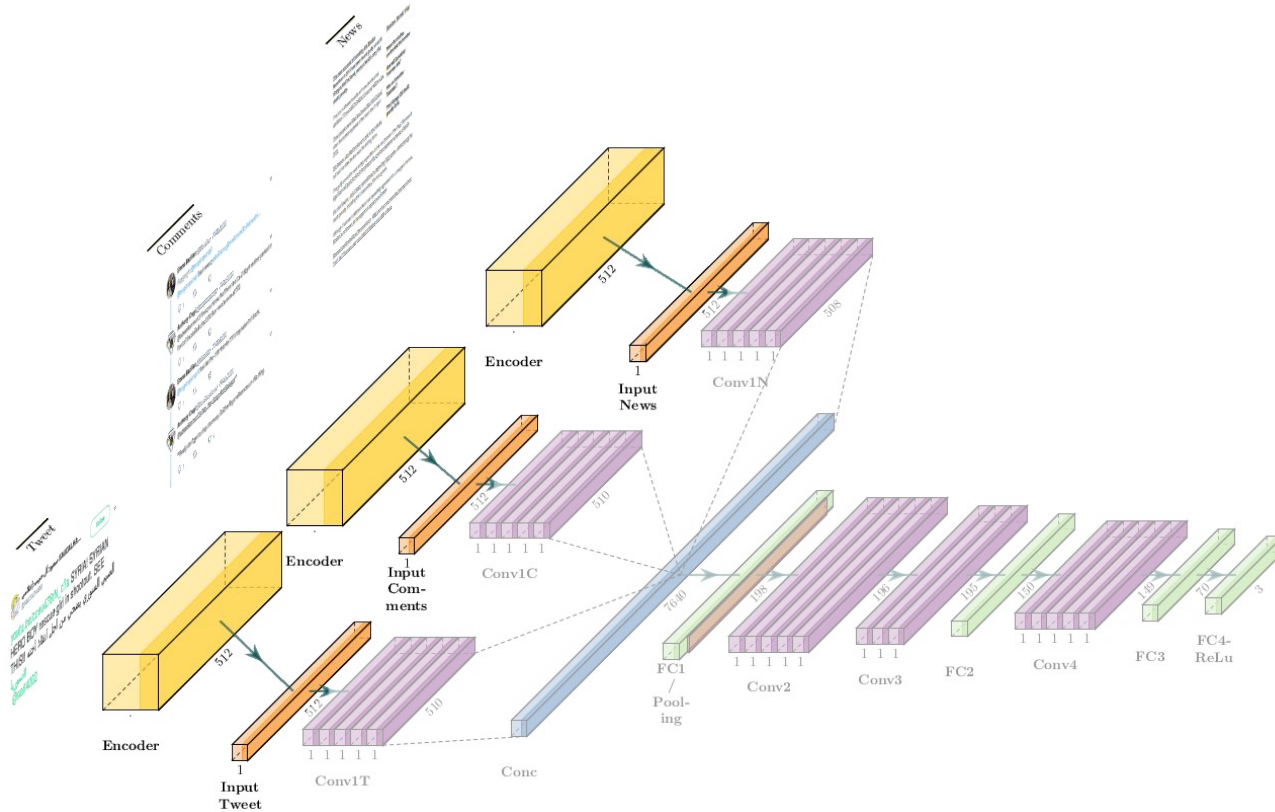


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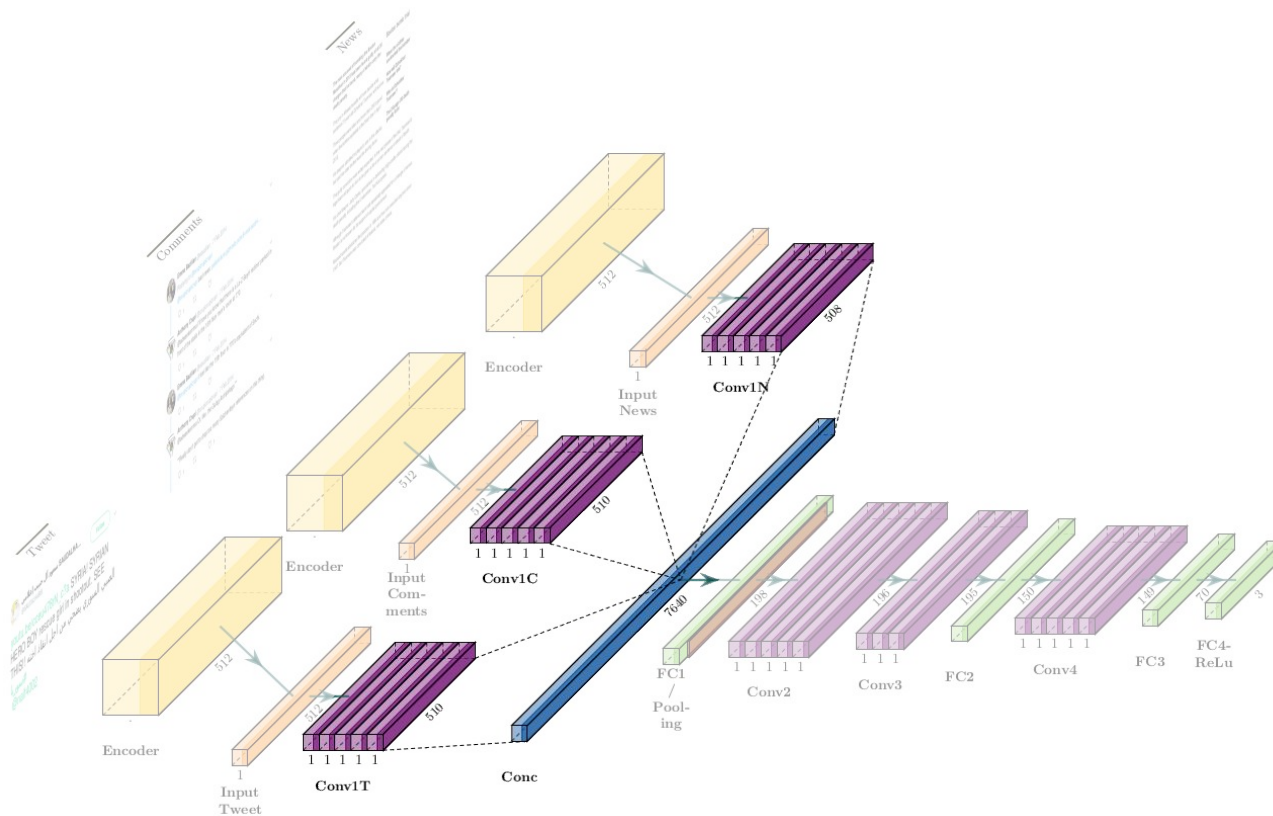
EMET: Problem statement



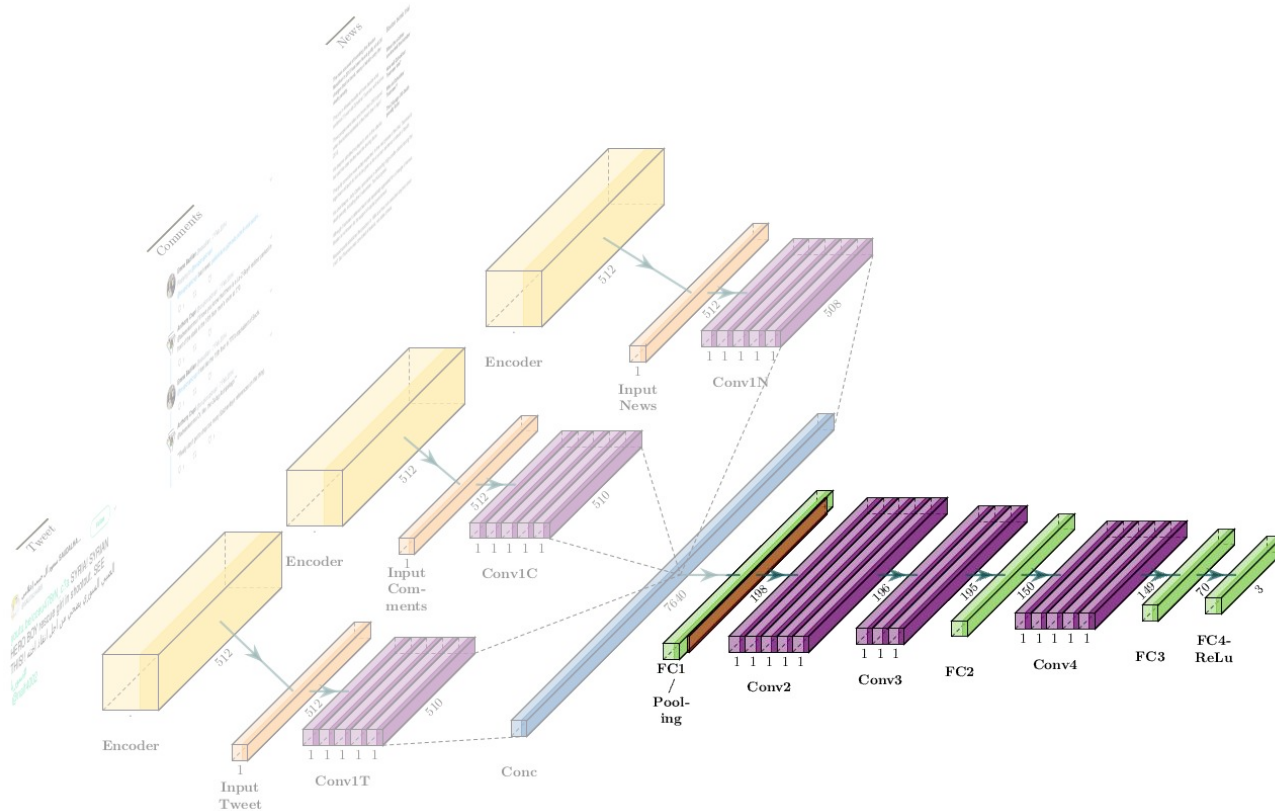
EMET: Input



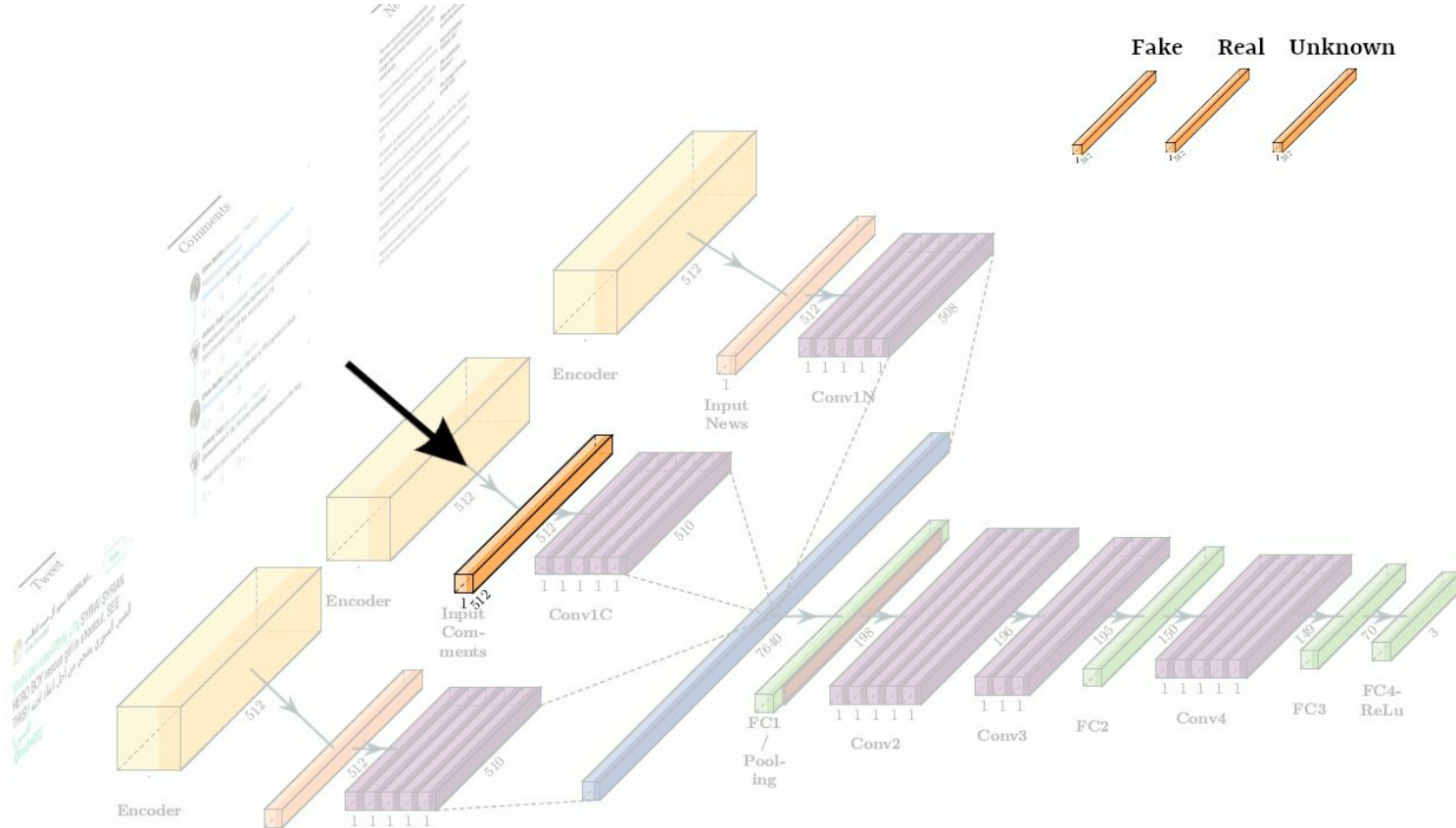
EMET: Convolution



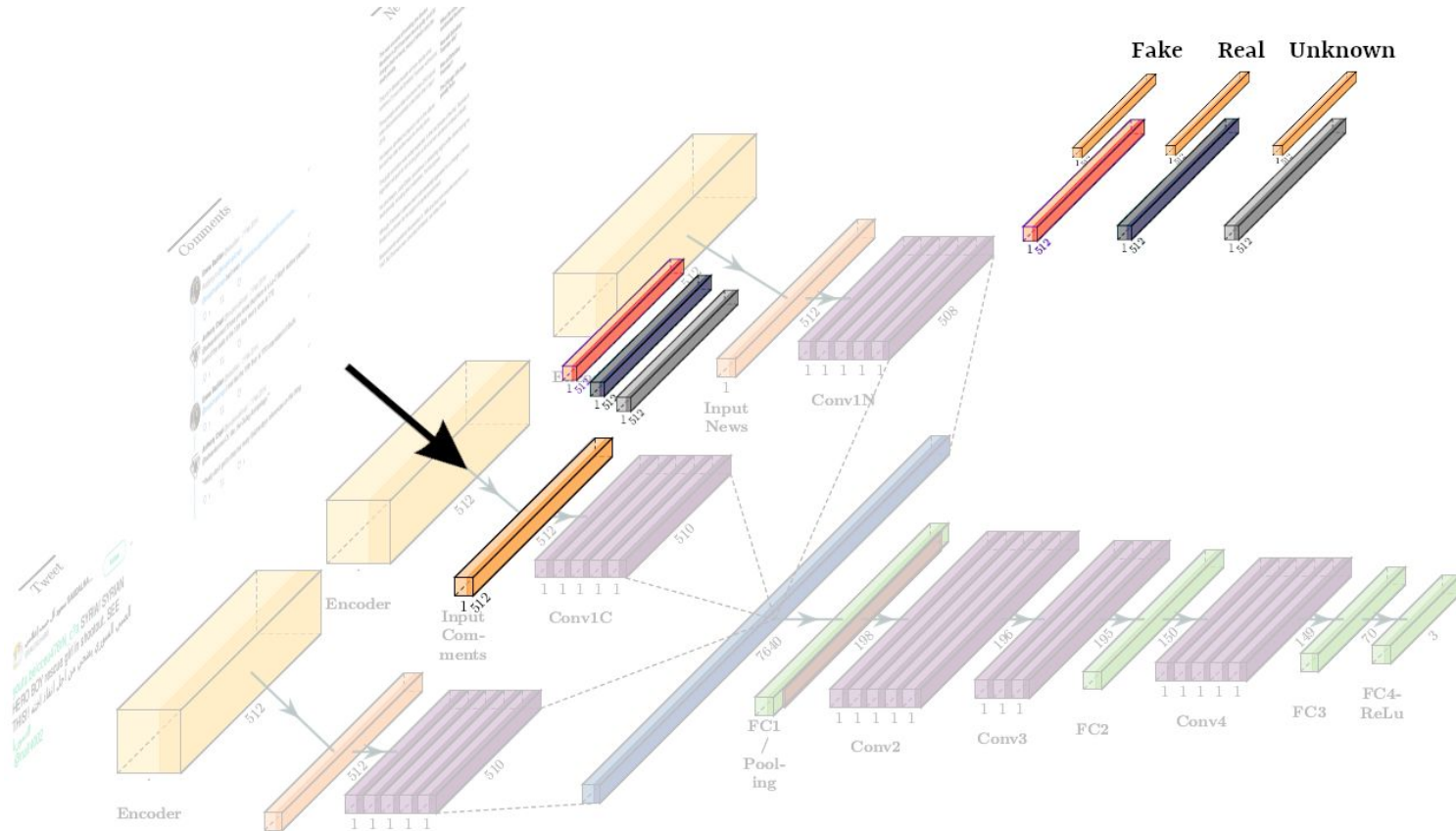
EMET: Fully-connected



EMET : Classification Ensemble – Training



EMET : Classification Ensemble-Testing



Experimental Results: Questions

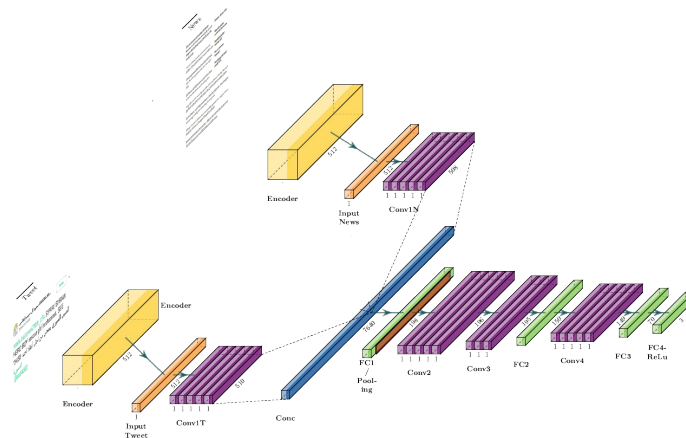


- How text embeddings from a multilingual encoder and the us-age of news pieces improve the identification of misleading content on social media?
- How the comments contribute to improving classification performance?
- How the ensemble method capture general information to better model the test set?

Experimental Setup: **Unchecked news** (UNC)



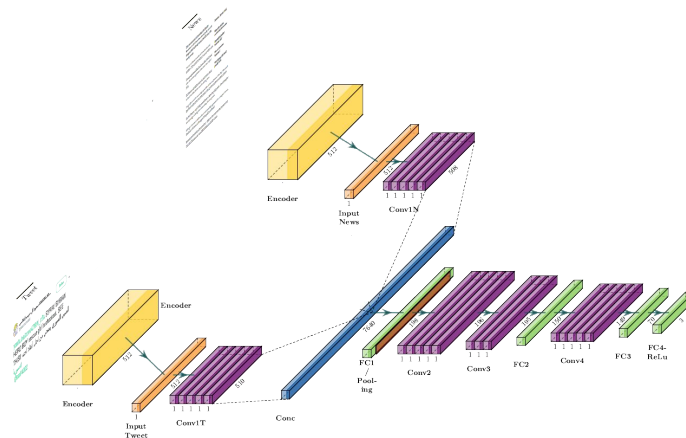
Method	Accuracy	Precision	Recall	F1
UCN	76.4	76.9	76.4	75.2
EANN-Text [6]	53.2	59.8	54.1	56.8
MVAE-Text [7]	52.6	52.7	53.9	53.2



Experimental Setup: Checked news (CN)



Method	Accuracy	Precision	Recall	F1
CN	92.92	92.99	92.92	92.94
EANN-Text	53.2	59.8	54.1	56.8
MVAE-Text	52.6	52.7	53.9	53.2



Experimental Results: Questions

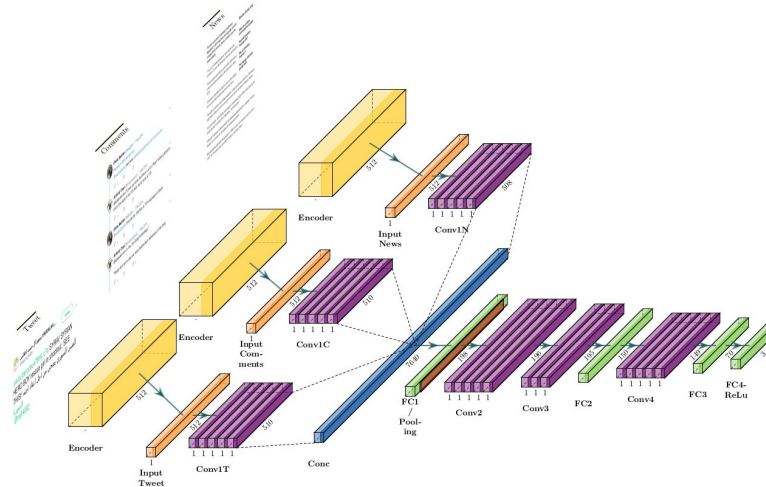


- How text embeddings from a multilingual encoder and the us-age of news pieces improve the identification of misleading content on social media?
- How the comments contribute to improving classification performance?
- How the ensemble method capture general information to better model the test set?

Experimental Setup: CN and comments (CNC)



Method	Accuracy	Precision	Recall	F1
CN	92.92	92.99	92.92	92.94
CNC	93.47	93.91	93.47	93.61



Experimental Results: Questions

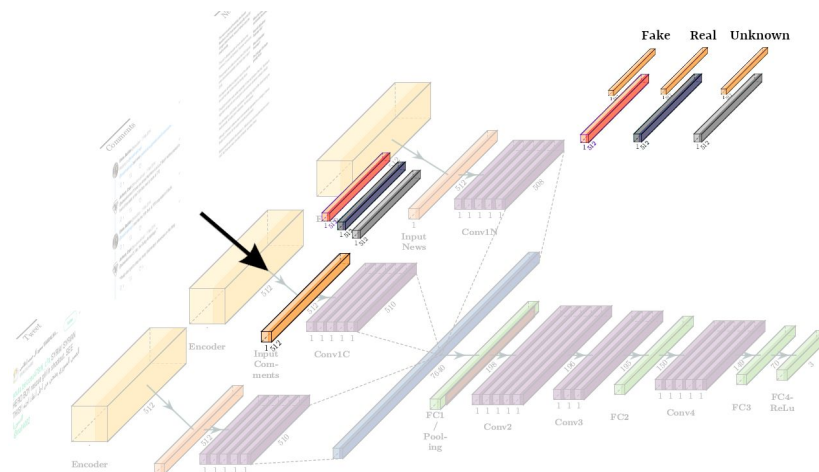


- How text embeddings from a multilingual encoder and the us-age of news pieces improve the identification of misleading content on social media?
- How the comments contribute to improving classification performance?
- How the ensemble method capture general information to better model the test set?

Experimental Setup: CNC and ensemble (CNCE)



Method	Accuracy	Precision	Recall	F1
CNC	93.47	93.91	93.47	93.61
CNCE	94.08	91.31	91.21	91.26





EMET helps to address the problem of fake news detection on social media platforms in a multilingual scenario.



Explore Multi Domain data (Image + Text)

Acknowledgments



References



[1] Pew Research Center. Social media fact sheet. <https://www.pewresearch.org/internet/fact-sheet/social-media>

[2] Samantha Bradshaw and Philip N. Howard. 2019 global inventory of organised social media manipulation. <https://comprop.oii.ox.ac.uk/wp-content/uploads/sites/93/2019/09/CyberTroop-Report19.pdf>, 2019. [Online; accessed on October 10 th , 2019].

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[4] Peng Qi, et al. Exploiting multi-domain visual information for fake news detection. arXiv preprint arXiv:1908.04472, 2019.

[5] Antônio Theóphilo et al. A needle in a haystack? harnessing onomatopoeia and user-specific stylometrics for authorship attribution of micromessages. In ICASSP 2019–2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), pages 2692–2696. IEEE, 2019.

[6] MediaEval Multimedia Benchmark. 2015 verifying multimedia use dataset. <http://www.multimediaeval.org/mediaeval2015/verifyingmultimediause/>, 2015. [Online; accessed on October 10 th , 2019].

[7] Yaqing Wang et al.. Eann: Event adversarial neural networks for multi-modal fake news detection. In Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining, pages 849–857. ACM, 2018.

[8] Dhruv Khattar et al. Mvae: Multimodal variational autoencoder for fake news detection. In The World Wide Web Conference, pages 2915–2921. ACM, 2019.

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