

Appendices

A Proxy Test of Black-box Model Explanations

There are several black-box model explanations to consider for the task. While testing all of them on real users can be an interesting research on its own, as we are more broadly interested in what distinct types of information could be helpful, we decide to select one representative method in the literature. As there is no absolute answer to which method is superior, we conduct a simple proxy test of what method can be a better choice for the task.

We consider the following feature attribution methods: Integrated Gradients (Sundararajan et al., 2017), Input x Gradients (Shrikumar et al., 2016), and SHAP (Lundberg & Lee, 2017). In Figure 10, we plot the mean EM distance (averaged across 50 different random attributions, normalized to be between 0 and 1) between the distribution of attribution scores for the input tokens in our ground-truth articles. The higher the value (darker the color), the more distinct the distribution of the attribution scores computed by respective methods. Notice that SHAP shows the most distinct distribution from random attributions compared to other methods, indicating it may be a better choice that carry more information about the important tokens. We have also qualitatively verified that the highlights from other two methods were not as meaningful as SHAP on the articles.

Note also that SHAP is a promising candidate to apply to the task due to its popularity and its common presence in more sophisticated domains like biology, physics, chemistry, and finance (Jesus et al., 2021; Novakovsky et al., 2022; Yang et al., 2022; Zablocki et al., 2022; Pucci et al., 2022).

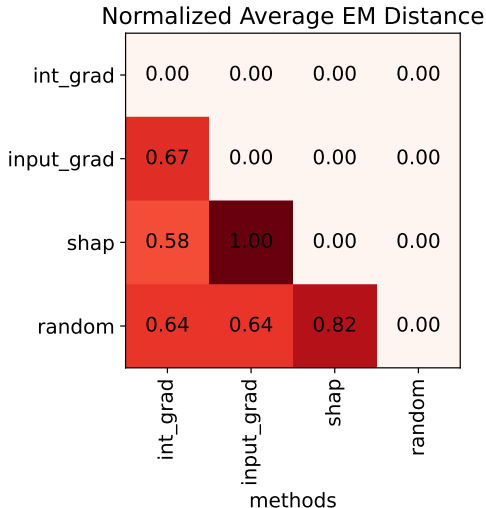


Figure 10: Proxy quality test for the black-box model explanations using average EM distances between the distributions of attribution scores of input tokens. The higher the values (the darker the color), the more different the distribution of the attribution scores. SHAP shows the most distinct distribution from the random attributions (bottom row).

B Method Examples

We show below some example highlights presented to the users using different methods.

Summary		
The United Nations Relief and Works Agency chief will visit Yarmouk camp Saturday . Militant groups are currently in control of the camp . Yarmouk has been engulfed in fighting since December 2012 .		
Article 1 --- Score: 0.75	Article 2 --- Score: 0.73	Article 3 --- Score: 0.72
<p>CNN) The commissioner - general of the United Nations Relief and Works Agency will make an emergency visit to the Yarmouk Palestinian refugee camp in Syria on Saturday, a spokesman says. Commissioner - General Pierre Krähenbühl will assess the humanitarian situation in the camp and speak with individuals about ways to relieve the suffering of the people who remain there. The visit is prompted by UNRWA's deepening concern for the safety and protection of 18,000 Palestinians and Syrian civilians, including 3,500 children," agency spokesman Christopher Gunness told CNN's Paula Newton. "Yarmouk remains under the control of armed groups, and civilian life continues to be threatened by the effects of the conflict." Krähenbühl will meet with senior Syrian officials, U. N. and relief agency staff members, and displaced people from the camp itself. The Yarmouk refugee camp, which sits just 6 miles from central Damascus, has been engulfed in fighting between the Syrian government and armed groups since December 2012. The London - based Syrian Observatory for Human Rights says the militant group ISIS and the al Qaeda - affiliated Al - Nusra Front control about 90% of the camp. The organization also claims that the Syrian government has dropped barrel bombs on the camp as recently as Sunday in an effort to drive out armed groups. Yarmouk was formed in 1957 to accommodate people displaced by the Arab - Israeli conflict and is the largest Palestinian refugee camp in Syria. The U. N. relief agency estimates that there were 160,000 people in the camp when the conflict began in 2011 between forces loyal to President Bashar al - Assad and opposition fighters. That number has dropped to about 18,000, according to estimates. Yarmouk has been largely cut off from aid since November 2013. There have been widespread reports of malnutrition and shortages of medical care. "We will not abandon hope," Gunness said. "We will not submit to pessimism, because to abandon hope would be to abandon the people of Yarmouk. ... We cannot abandon the people of Yarmouk, and we will not, hence this mission."</p>	<p>CNN) Thousands of Palestinians are trapped in the devastated Yarmouk refugee camp in Syria, which has mostly been seized by groups including ISIS, activists report. The London - based Syrian Observatory for Human Rights says ISIS and the al Qaeda - affiliated Al - Nusra Front took control of 90% of the camp in southern Damascus. Calling the lives of Yarmouk refugees "profoundly threatened "on Sunday, the United Nations Relief and Works Agency issued a statement urging humanitarian aid access. "Never has the hour been more desperate in the Palestine refugee camp of Yarmouk," the statement said. The UNRWA estimates 18,000 civilians remain trapped in the camp that has been engulfed in fighting between the government and rebel forces since December 2012. Syria's state - run SANA news agency reports up to 2,000 people have fled in the past two days as food, water and medical supplies remain scarce. "All people are trying to leave the camp," says Syrian activist Abu Mohammed in Damascus who used to live in Yarmouk. "There is no electricity," says Mohammed. "ISIS controls the hospital so injured people have nowhere to go." The Syrian Observatory for Human Rights reports barrel bombs were dropped on the camp Sunday as clashes continued. The Palestine Liberation Organization called on international bodies to assist in the evacuation of people from the camp. "Reports of kidnappings, beheadings and mass killings are coming out from Al - Yarmouk, which is under a brutal campaign of murder and occupation," Palestine Liberation Organization Executive Committee Member Dr. Saeb Erekat said Saturday. Yarmouk, the largest Palestinian refugee camp in Syria, was formed in 1957 to accommodate people fleeing the Arab - Israeli conflict. "The levels of humanity that we have seen have now descended into further levels of inhumanity," said Chris Gunness, spokesman for the UNRWA. Yarmouk, he added, "was always a place where human rights meant very little. We are seeing it descend further." CNN's Samira Said contributed to this report.</p>	<p>CNN) They took Yarmouk by storm, a sea of masked men flooding into the streets of one the world's most beleaguered places. Besieged and bombed by Syrian forces for more than two years, the desperate residents of this Palestinian refugee camp near Damascus awoke in early April to a new, even more terrifying reality -- ISIS militants seizing Yarmouk after defeating several militia groups operating in the area. "They slaughtered them in the streets," one Yarmouk resident, who asked not to be named, told CNN. "They caught) three people and killed them in the street, in front of people. The Islamic State is now in control of almost all the camp." An estimated 18,000 refugees are now trapped inside Yarmouk, stuck between ISIS and Syrian regime forces in "the deepest circle of hell," in the words of U. N. Secretary - General Ban Ki - moon. Yarmouk, the largest Palestinian refugee camp in Syria, was formed in 1957 to accommodate people fleeing the Arab - Israeli conflict. 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"We need medicine and access to treatment and medical facilities," Wesam Sabaneh told CNN. "The last hospital in Yarmouk camp was bombed yesterday, so there's really nothing functioning." Opinion: Save the 'miracle babies' Even delivering clean water in Yarmouk can be a deadly task. Majed Alomari, the Jafra Foundation's water coordinator, was killed a few days ago -- gunned down in an ISIS firefight with rival rebel groups. The head of the Palestinian League for Human Rights in Syria</p>

Figure 11: Example highlights for SHAP.

Summary

The United Nations Relief and Works Agency chief will visit Yarmouk camp Saturday . Militant groups are currently in control of the camp . Yarmouk has been engulfed in fighting since December 2012 .

Article 1 --- Score: 0.75

(CNN)The commissioner-general of the United Nations Relief and Works Agency will make an emergency visit to the Yarmouk Palestinian refugee camp in Syria on Saturday, a spokesman says. Commissioner-General Pierre Krähenbühl will assess the humanitarian situation in the camp and speak with individuals about ways to relieve the suffering of the people who remain there. "The visit is prompted by UNRWA's deepening concern for the safety and protection of 18,000 Palestinians and Syrian civilians, including 3,500 children," agency spokesman Christopher Gunness told CNN's Paula Newton. "Yarmouk remains under the control of armed groups, and civilian life continues to be threatened by the effects of the conflict." Krähenbühl will meet with senior Syrian officials, U.N. and relief agency staff members, and displaced people from the camp itself. The Yarmouk refugee camp, which sits just 6 miles from central Damascus, has been engulfed in fighting between the Syrian government and armed groups since December 2012. The London-based Syrian Observatory for Human Rights says the militant group ISIS and the al Qaeda-affiliated Al-Nusra Front control about 90% of the camp. The organization also claims that the Syrian government has dropped barrel bombs on the camp as recently as Sunday in an effort to drive out armed groups. Yarmouk was formed in 1957 to accommodate people displaced by the Arab-Israeli conflict and is the largest Palestinian refugee camp in Syria. The U.N. relief agency estimates that there were 160,000 people in the camp when the conflict began in 2011 between forces loyal to President Bashar al-Assad and opposition fighters. That number has dropped to about 18,000, according to estimates. Yarmouk has been largely cut off from aid since November 2013. There have been widespread reports of malnutrition and shortages of medical care. "We will not abandon hope," Gunness said. "We will not submit to pessimism, because to abandon hope would be to abandon the people of Yarmouk. ... We cannot abandon the people of Yarmouk, and we will not, hence this mission."

Article 2 --- Score: 0.73

(CNN)Thousands of Palestinians are trapped in the devastated Yarmouk refugee camp in Syria, which has mostly been seized by groups including ISIS, activists report. The London-based Syrian Observatory for Human Rights says ISIS and the al Qaeda-affiliated Al-Nusra Front took control of 90% of the camp in southern Damascus. Calling the lives of Yarmouk refugees "profoundly threatened" on Sunday, the United Nations Relief and Works Agency issued a statement urging humanitarian aid access. "Never has the hour been more desperate in the Palestine refugee camp of Yarmouk," the statement said. The UNRWA estimates 18,000 civilians remain trapped in the camp that has been engulfed in fighting between the government and rebel forces since December 2012. Syria's state-run SANA news agency reports up to 2,000 people have fled in the past two days as food, water and medical supplies remain scarce. "All people are trying to leave the camp," says Syrian activist Abu Mohammed in Damascus who used to live in Yarmouk. "There is no electricity," says Mohammed. "ISIS controls the hospital so injured people have nowhere to go." The Syrian Observatory for Human Rights reports barrel bombs were dropped on the camp Sunday as clashes continued. The Palestine Liberation Organization called on international bodies to assist in the evacuation of people from the camp. "Reports of kidnappings, beheadings and mass killings are coming out from Al- Yarmouk, which is under a brutal campaign of murder and occupation," Palestine Liberation Organization Executive Committee Member Dr. Saeb Erekat said Saturday. Yarmouk, the largest Palestinian refugee camp in Syria, was formed in 1957 to accommodate people fleeing the Arab-Israeli conflict. "The levels of humanity that we have seen have now descended into further levels of inhumanity," said Chris Gunness, spokesman for the UNRWA. Yarmouk, he added, "was always a place where human rights meant very little. We are seeing it descend further." CNN's Samira Said contributed to this report .

Article 3 --- Score: 0.72

(CNN)They took Yarmouk by storm, a sea of masked men flooding into the streets of one the world's most beleaguered places. Besieged and bombed by Syrian forces for more than two years, the desperate residents of this Palestinian refugee camp near Damascus awoke in early April to a new, even more terrifying reality -- ISIS militants seizing Yarmouk after defeating several militia groups operating in the area. "They slaughtered them in the streets," one Yarmouk resident, who asked not to be named, told CNN. "They (caught) three people and killed them in the street, in front of people. The Islamic State is now in control of almost all the camp." An estimated 18,000 refugees are now trapped inside Yarmouk, stuck between ISIS and Syrian regime forces in "the deepest circle of hell," in the words of U.N. Secretary-General Ban Ki-moon. Yarmouk, the largest Palestinian refugee camp in Syria, was formed in 1957 to accommodate people fleeing the Arab-Israeli conflict. The camp, which sits just 6 miles from central Damascus, has been engulfed in fighting between the Syrian government and armed groups since December 2012. The London-based Syrian Observatory for Human Rights says ISIS and the al Qaeda-affiliated Al-Nusra Front control about 90% of the camp. The organization also claims that the Syrian government has dropped barrel bombs on the camp in an effort to drive out armed groups. Activists and residents in Yarmouk tell CNN that as many as 5,000 people have tried to flee their homes since ISIS stormed the camp, but have no place to go. Hundreds have been injured, but the camp's only functioning hospital was first occupied by ISIS, then targeted last week by regime shelling. As the fighting raged in Yarmouk, the director of the Jafra Foundation -- the only aid group that has been able to get into the camp -- painted a grim portrait of the conditions on the ground since ISIS arrived. "We need medicine and access to treatment and medical facilities," Wesam Sabaneh told CNN. "The last hospital in Yarmouk camp was bombed yesterday, so there's really nothing functioning." Opinion: Save the 'miracle babies' Even delivering clean water in Yarmouk can be a deadly task. Majed Alomari, the Jafra Foundation's water coordinator, was killed a few days ago -- gunned down in an ISIS firefight with rival rebel groups. The head of the Palestinian League for Human Rights in Syria (PLHR), who fled the camp and Syria in October 2012, said the people of Yarmouk were in dire need of help.

Figure 12: Example highlights for BERTSum.

Summary

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(CNN) The commissioner - general of the United Nations Relief and Works Agency will make an emergency visit to the Yarmouk Palestinian refugee camp in Syria on Saturday , a spokesman says . Commissioner - General Pierre Krähenbühl will assess the humanitarian situation in the camp and speak with individuals about ways to relieve the suffering of the people who remain there . `` The visit is prompted by UNRWA 's deepening concern for the safety and protection of 18,000 Palestinians and Syrian civilians , including 3,500 children , " agency spokesman Christopher Gunness told CNN 's Paula Newton . `` Yarmouk remains under the control of armed groups , and civilian life continues to be threatened by the effects of the conflict . " Krähenbühl will meet with senior Syrian officials , U.N. and relief agency staff members , and displaced people from the camp itself . The Yarmouk refugee camp , which sits just 6 miles from central Damascus , has been engulfed in fighting between the Syrian government and armed groups since December 2012 . The London - based Syrian Observatory for Human Rights says the militant group ISIS and the al Qaeda - affiliated Al - Nusra Front control about 90 % of the camp . The organization also claims that the Syrian government has dropped barrel bombs on the camp as recently as Sunday in an effort to drive out armed groups . Yarmouk was formed in 1957 to accommodate people displaced by the Arab - Israeli conflict and is the largest Palestinian refugee camp in Syria . The U.N. relief agency estimates that there were 160,000 people in the camp when the conflict began in 2011 between forces loyal to President Bashar al - Assad and opposition fighters . That number has dropped to about 18,000 , according to estimates . Yarmouk has been largely cut off from aid since November 2013 . There have been widespread reports of malnutrition and shortages of medical care . `` We will not abandon hope , " Gunness said . `` We will not submit to pessimism , because to abandon hope would be to abandon the people of Yarmouk We can not abandon the people of Yarmouk , and we will not , hence this mission . "

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(CNN) Thousands of Palestinians are trapped in the devastated Yarmouk refugee camp in Syria , which has mostly been seized by groups including ISIS , activists report . The London - based Syrian Observatory for Human Rights says ISIS and the al Qaeda - affiliated Al - Nusra Front took control of 90 % of the camp in southern Damascus . Calling the lives of Yarmouk refugees `` profoundly threatened " on Sunday , the United Nations Relief and Works Agency issued a statement urging humanitarian aid access . `` Never has the hour been more desperate in the Palestine refugee camp of Yarmouk , " the statement said . The UNRWA estimates 18,000 civilians remain trapped in the camp that has been engulfed in fighting between the government and rebel forces since December 2012 . Syria 's state - run SANA news agency reports up to 2,000 people have fled in the past two days as food , water and medical supplies remain scarce . `` All people are trying to leave the camp , " says Syrian activist Abu Mohammed in Damascus who used to live in Yarmouk . `` There is no electricity , " says Mohammed . `` ISIS controls the hospital so injured people have nowhere to go . " The Syrian Observatory for Human Rights reports barrel bombs were dropped on the camp Sunday as clashes continued . The Palestine Liberation Organization called on international bodies to assist in the evacuation of people from the camp . `` Reports of kidnappings , beheadings and mass killings are coming out from Al - Yarmouk , which is under a brutal campaign of murder and occupation , " Palestine Liberation Organization Executive Committee Member Dr. Saeb Erekat said Saturday . Yarmouk , the largest Palestinian refugee camp in Syria , was formed in 1957 to accommodate people fleeing the Arab - Israeli conflict . `` The levels of humanity that we have seen have now descended into further levels of inhumanity , " said Chris Gunness , spokesman for the UNRWA . Yarmouk , he added , `` was always a place where human rights meant very little . We are seeing it descend further . " CNN 's Samira Said contributed to this report .

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Figure 13: Example highlights for Co-occurrence method.

Summary

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Article 3 --- Score: 0.72

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Figure 14: Example highlights for Semantic method.

C User Study Details

C.1 Pilots and Sample Size

Prior to conducting the actual user study, we ran pilot studies on a smaller number of participants. Using the data points collected from these studies, we conducted a Monte Carlo simulation-based power analysis to determine the effective sample size. We determined to recruit 55 participants per condition (so total of $275 = 55 \times 5$ conditions) for a statistical power over 0.8 with the effect size (Cohen’s d) of 0.5 (orange line with circle markers in Figure 15). This effect size corresponds to 0.1 difference in the mean accuracy between the control and the treatment.

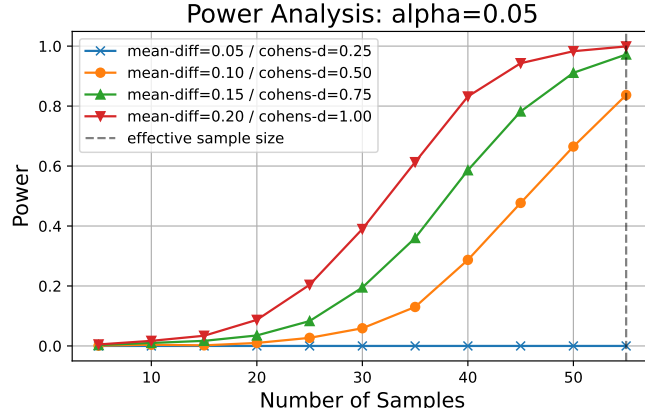


Figure 15: Power analysis for the effective sample size. We collect 55 samples per group (vertical dotted line) for a statistical power over 0.8 for the effect size (Cohen’s d) of 0.5 (orange line with circle markers).

C.2 Demographic Background

In Figure 16, we provide demographic background of the participants (age, ethnicity, student status, employment status) recruited for the study. 275 participants were recruited from a balanced pool of adult males and females located in the U.S. with minimum approval ratings of 90% using Prolific (www.prolific.co).

C.3 Tutorial

We provide the participants with a set of instructions laying out what the highlights indicate and how one might use them for the task. The instruction is followed by two sample questions on which the participants could take unlimited time to get an understanding of what the questions look like. For the sample questions, the participants were provided the correct answers and the justification behind them as feedback.

C.4 Payments

Base payment per participants was \$3.15, determined based on the minimum hourly payment set by the platform and the median completion time of all participants, resulting in an average reward of \$12.07 per hour. To encourage quicker and more accurate responses, we designed bonus payments so that each participant could earn additional \$ (base payment for the question \times multiplier) for each correctly answered questions, where the multiplier is determined by the response time on the question (Table 1). One could ideally earn up to $\times 1.5$ the base payment by answering all questions correctly, all within 30 seconds. All payments (base and bonus) were processed after the data collection was complete, accounting for invalid responses.

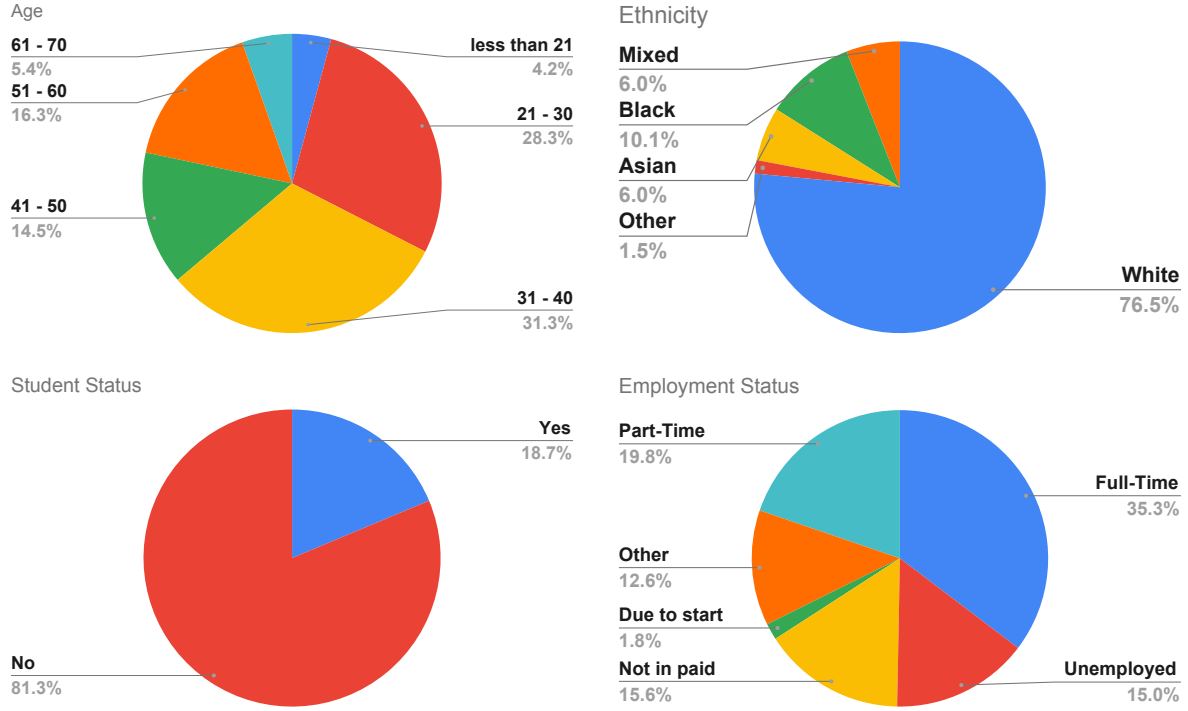


Figure 16: Demographic background of the participants (age, ethnicity, student status, and employment status).

Response Time (seconds)	< 30	< 60	< 90	< 120	> 120
Multiplier	x0.5	x0.4	x0.3	x0.2	x0.0

Table 1: Reward multiplier based on response time for correct answers. Incorrect answers have the multiplier of zero.