Brown Undergraduate Research Journal

Brown
Research
Club

Spring 2022

S p r i n g

2
0
2
2

Brown Undergraduate Research Journal

Brown Research Club

About Us

First published in Spring 2019, the Brown Undergraduate Research Journal (BURJ) was developed by the Brown Research Club (BRC) in order to provide a unique platform for the showcasing of research completed by undergraduates and recent Brown University graduates. This work may have been completed in a University laboratory in collaboration with a faculty member, independently with the use of archival materials, or during the summer through a research internship.

One of the central aims of the BURJ is to be inclusive of all topic areas, and that is truer in this issue than ever before. We were thrilled to receive submissions ranging in focus from English, to computational biology, to public health. Ultimately, our goal is to empower students at Brown to hone and demonstrate their academic writing skills, regardless of concentration or career trajectory. This ambitious goal could not have been achieved without the invaluable contributions of our incredibly talented BRC Journals team, which was responsible for the editing and compilation of this journal:

Editing
Kat Clum ‘22
Nathalie Felton ‘23
Mehak Malhotra ‘24
Saradha Miryala ‘23

Graphic Design and Assembly
Alyssa Steinbaum ‘23

We hope that you enjoy the third issue of the BURJ and thank you for supporting Brown’s undergraduate research community!

Rahma Ibrahim ‘22 and Evan Mizerak ‘22

BRC Co-Presidents

Table of Contents

Shakespeare and Social Death

Author: Noah Baum
PI: Connie Scozzaro (Brown University)
Field: Philosophy, English/Literature

Introduction

Shakespeare is notorious for his deaths. In critical discourse, death and its timings in Shakespeare's writing have long been the subject of literary study. While contemplation of physical death has plagued actors, directors, and critics alike for centuries, scholars have recently examined how social death functions in Shakespeare. In this essay, I join this discursive turn from physical death into social death, asking by what means one renders another person socially dead and whether this classification can be reversed. I analyze The Tempest for its variety of bodies: Black male bodies, Black female bodies, white male bodies, white female bodies, and even the immaterial "body" of spirits.[1]

What is Social Death?

The term "social death" was popularized by Orlando Patterson in Slavery and Social Death and has since been adopted across disciplines to investigate power and personhood.[1] While the definition of social death has accrued nuance as an interdisciplinary tool, sociologist Jana Králová clarifies it as "a complex, multidimensional, relational series of losses," and has identified three key components of social death: "a loss of social identity, a loss of social connectedness, and losses associated with disintegration of the body."[2] Further, social death must be imposed upon someone by another person or group, often as a "substitute for [physical] death."[3]

Ariel

I argue that the spirit Ariel occupies a state as close to social death as a spirit can approach, reversed in his eventual "release." The relationship between Prospero and Ariel is one of absolute servitude. Caliban notes that the spirits lie dormant "unless [Prospero] bid 'em," suggesting that, borrowing from Patterson, Ariel has "no socially recognized existence outside of his master."[5] To fulfill the physical criteria of social death, Ariel's "body" is trapped inside "a cloven pine…/ Imprisoned [for] / A dozen years."[6] I concede that Ariel is released by Prospero at the play's end, but the fact that Prospero has the authority to "release" Ariel, whom he calls his "slave," via imperative ("That is thy charge. Then to the elements / Be free") indicates the degree to which Ariel functions as a social nonperson throughout the text.[7]

Caliban

Since the isolated setting of the island prevents Prospero from dehumanizing Caliban for his Blackness with the systemic subjugation possible on the mainland, I argue that Caliban is not socially dead, but that he instead works to resist social death. We first hear about Caliban when Prospero mentions his mother, Sycorax.[8] Thus, Caliban does not experience "natal alienation"—he feels social connectedness to his ancestors. Further, he feels a social connection with his descendants, seen in his famous threat to "people… / this isle with Calibans."[9] Additionally, Caliban is able to form new social connections with Trinculo and Stephano, convincing them to help him dethrone his oppressor. Finally, Caliban is often the only one in these scenes to speak in verse—such elevated speech by the would-be victim of social death strongly suggests a resistance to it.[10] This is all possible due to Caliban being in a one-to-one relation with his oppressor. Perhaps then, the text suggests that in order to truly enact social death, it must be imposed systemically and institutionally, and not on a one-to-one scale.

Sycorax

While we might expect the text's one Black woman to be particularly vulnerable to social death, The Tempest presents Sycorax as autonomous and powerful. Prospero reveals that Sycorax was "so strong / That [she] could control the moon, make flows and ebbs," and further, she held Ariel in social death before Prospero did.[11] While Sycorax is socially dead from the perspective of the mainland (being banished from Algiers for "sorceries terrible"), on the is

land, where she was a mother and could impose social death upon other beings, I contend that Sycorax remained alive, both socially and physically, until her physical death.[12]

Through Prospero and Miranda, I argue that social death can occasionally be reversed. As exiles, they are socially dead from the mainland perspective. However, by virtue of their privileged bodies and the transport back to the mainland offered by the play's conclusion, it seems they will return to social life. Miranda is socially connected to her father Prospero and exerts power over others by teaching Caliban language, influencing the very tongue in which Caliban speaks (that is, presents his own agency) for the entire play.[13] Colonial as it is, there is undeniably power here. Furthermore, Miranda's linguistic faculty culminates in Prospero's approval of her desired union between her and Ferdinand. Thus, I contend that Miranda exists as socially alive on the island, and that while she is initially socially dead in the eyes of the mainland, this social death will be reversed as she returns to Milan as the daughter of the duke and bride of a prince.

Prospero

Prospero holds the most social power in the play. While Miranda's social death is reversed, it is only by virtue of Prospero's planning and power as he seeks to reverse his own social death that this comes to pass. Prospero has a firm grasp on his identity as the wrongfully deposed Duke of Milan; a strong understanding of his social roles and relations as father to Miranda, brother to Antonio, husband to his deceased wife, and master to Caliban and Ariel; and finally, as someone with a white, male, abled body, he experiences none of Králová's bodily disintegration. In terms of his magical prowess, Prospero summons the tempest which lends the play its name, demonstrating, in a meta sense, his power to influence his surroundings. While it would be inappropriate for him to wreak magical havoc on the mainland as nobility, he will exchange his magical power for mighty armies, maintaining his world-altering strength.

Conclusion

Based on its power relations, The Tempest suggests a reading of social death contending that, in order for social death to truly take root, it must be enacted systemically. Additionally, with the exception of literal magical power, in one-

to-one intersubjective relations (without the weight of systemic power and discrimination), social death can in fact be resisted. Further, The Tempest posits that, in cases of exile, those with privileged bodies may be able to reverse their social death entirely.

References

1. William Shakespeare, *The Tempest* (Edited by Gordon McMullan, New York: Barnes & Noble Shakespeare, 2007).
2. Orlando Patterson, *Slavery and Social Death* (Cambridge: Harvard University Press, 1982).
3. Jana Králová, "What is social death?", *Contemporary Social Science*, 10:3, 235-248 (University of Bath: Bath, 2015), 243, 235.
4. Patterson, *Slavery and Social Death*, 5.
5. *Tempest* (II.ii.3, 7); Patterson, Ibid.
6. *Tempest* I.ii.274, 276-8.
7. *Tempest* I.ii.270, V.i.316-17.
8. *Tempest* I.ii.285
9. *Tempest* I.ii.350-52.
10. *Tempest* III.ii.131-39.
11. *Tempest* V.i.269-70; I.ii.271-275.
12. *Tempest* I.ii.264-68.
13. *Tempest* I.ii.355

Modeling CDOM Spectra from Satellite Measurements

Authors: Adam Furman, Mariam Ayad (University of California, Santa Cruz)

PI: Raphael Kudela (University of California, Santa Cruz)

Field: Remote Sensing, Ocean Science

Abstract

Colored Dissolved Organic Matter (CDOM) is an important indicator of the health and character of marine ecosystems. This study constructed a method for modeling CDOM absorption spectra based on satellite measurements of downwelling irradiance K_d and normalized water-leaving radiance L_{wn}. Because CDOM absorbs more blue than red light, the ratio of a blue-wavelength over a red-wavelength K_d or L_{wn} value was predicted to be correlated with absorption α. A linear relationship between both $\frac{K_d^{blue}}{K_d^{red}}$ and α as well as $\frac{L_{wn}^{blue}}{L_{wn}^{red}}$ and α on a logarithmic plot was found by processing a dataset of water samples measured in a laboratory setting. To predict a continuous spectrum, a decaying exponential model, parametrized by a reference absorption α_{440} and a spectral slope s, was used. A curve-fitting algorithm, given two different blue wavelengths and a constant red wavelength, found (α_{440}, s) values from K_d and L_{wn} ratios at those wavelengths. Error bounds for the algorithm were determined by comparing the fitted α_{440} and s values and the known values in the dataset. Using a second dataset linking spectral slope and absorption values to different qualitative CDOM types, a second algorithm was created to categorize an output (α_{440}, s).

The categorization method was then applied to imagery from the Sentinel-3 and GCOM-C satellites, resulting in geospatial data of the predicted CDOM type from L_{wn} values for each pixel of the image. The model results for one location, the Santa Cruz Wharf, were compared to ground-truth measurements. The categorization results were found to be accurate to the types of

water present in the vicinity but had a high error at the sampling location itself. Further study is needed to determine the effect of individual satellites on the outputs, and more ground data is needed to increase the precision of local results.

Introduction

Tracking dissolved organic matter is an important task when studying marine ecosystems. This study developed a way of modeling the entire CDOM absorption spectrum using two quantities that are measurable by satellites: the downwelling irradiance diffuse attenuation coefficient K_d and normalized water-leaving radiance L_{wn}. Both quantities are reported by discrete wavelengths. K_d is linked to how deep beneath the surface of the water light reaches at a given wavelength, and L_{wn} is how much light at a given wavelength is reflected off the surface of the water, corrected for observation angle. This paper first details how K_d and L_{wn} values were transformed into absorption spectra, then describes how those spectra were classified as different types of dissolved organic matter.

Methods

First, an appropriate mathematical representation of the CDOM absorption spectrum was chosen. The Twardowski et al. two-parameter exponential model1 was chosen because of its prevalence in the literature and because of its mathematical simplicity:

$$\alpha(\lambda) = \alpha_r e^{-s(\lambda-r)}$$

The formula requires a reference wavelength r, set at 440 nm in this study. The spectral slope s represents how quickly the absorption drops off at longer wavelengths, and the reference absorption ar is the absorption at the reference wavelength. Next, correlations between K_d and L_{wn} and absorption values were found. Because CDOM does not absorb at red wavelengths, ratios of $R_K = \frac{K_d^{blue}}{K_d^{red}}$ and $R_L = \frac{L_{wn}^{blue}}{L_{wn}^{red}}$ and were expected to scale with the chosen blue wavelength in a way that would correspond to absorption.

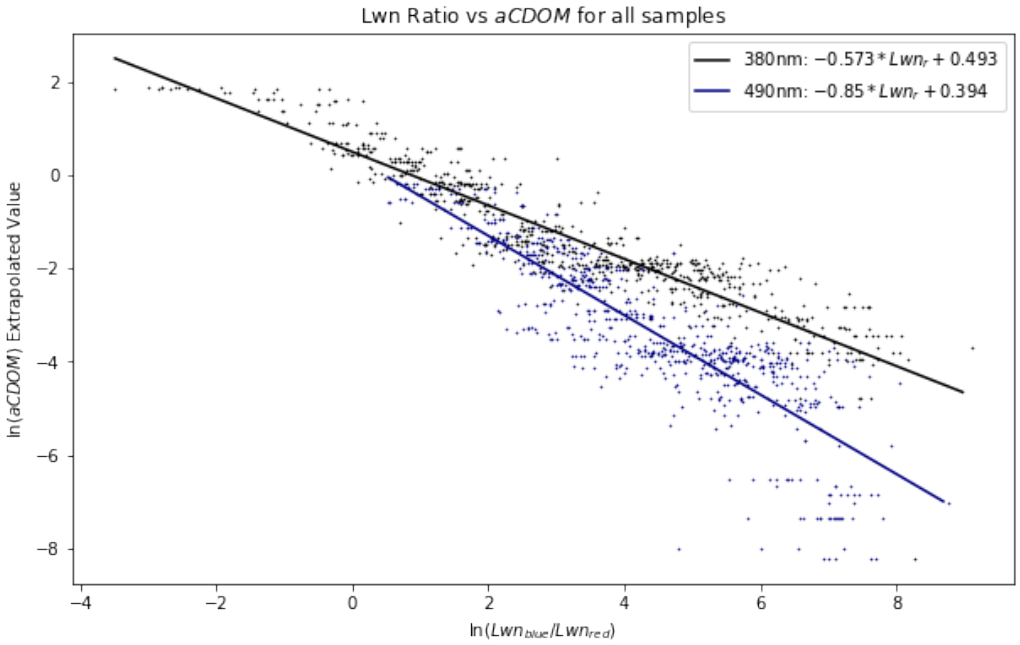

Figure 1: Linear fit of laboratory-measured data with two different wavelengths used as the blue wavelength in the ratio: 380 nm and 490 nm.

The relationship between the ratios and absorption, based on a dataset of lab-measured samples, was found to be linear on a log-log scale for both R_K and R_L, as shown in Figure 1.

Not all the ratios were found to fall on the linear fit, implying that the model works for most but not all types of CDOM.

The next step of the analysis was to generate a spectrum from two R_K or R_L values. Since the model has only two parameters, s and a440, only two values were required to generate a spectrum. After choosing two blue wavelengths and a red wavelength, two ratios were computed. Using the linear relationship found in the dataset, those ratios were converted to absorption values. Then, the exponential model was fit to those absorption values yielding a value for the reference absorption α_{440} and spectral slope s. Examining the root mean squared error across the samples in the dataset, this procedure was found to work best for samples with a K_d value under 0.5.

Once the process for converting the satellite-measurable values to reference absorptions and spectral slopes was developed, the second part of the study sought to classify these values by CDOM type. A second database of CDOM samples collected in the field and measured in the lab to determine

.

spectral slope and absorption at 440 nm was analyzed to find ranges of these values that corresponded to 16 labeled types of CDOM. These categories, determined in the dataset based on collection location and water conditions, included categories such as “River Mouth,” “Invasive Species,” and “Harmful Algal Bloom.”

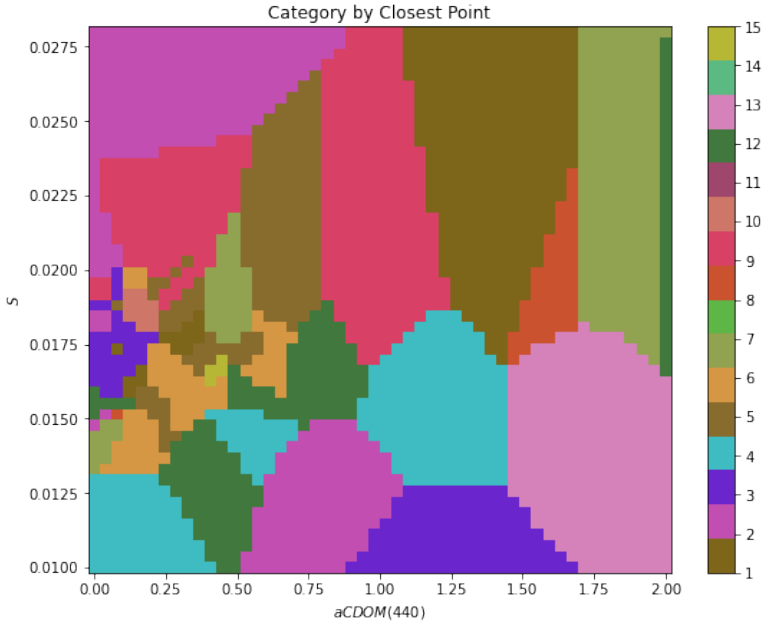

Figure 2: Colored CDOM categories by absorption and spectral slope.

The range of values in the dataset was plotted, and cluster analysis was used to determine which category was the most likely match for each combination of spectral slope and reference absorption. This is shown in Figure 2.

Finally, the two algorithms were combined, with the first part generating (α_{440}, s) values and the second part categorizing those values as a CDOM type. This could then be visualized graphically and applied directly to satellite imagery to yield geospatial data. Automated programs for doing so based on data from the GCOM-C and Landsat satellites were written.

Results and Ongoing Work

The methodology described above was applied to a limited set of data for which reference ground samples were available. Ground sampling was performed at the Santa Cruz Wharf in California and occurred during clear skies when the satellite was overhead on 13 October 2020, 27 October 2020, 24 March 2021, and 31 March 2021.

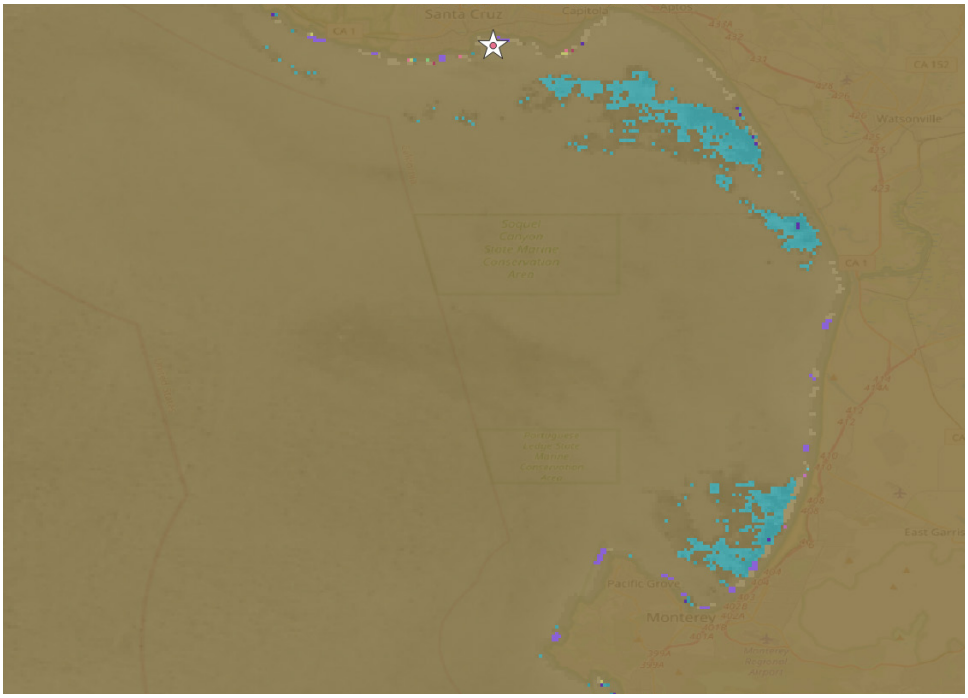

Figure 3: Processing applied to the 31 March 2021 image from the GCOM-C satellite.

Figure 3 shows the results of applying the processing algorithm to a satellite image. The star icon is Santa Cruz Wharf, the location of the ground sample taken during the same day as the satellite observation. The predominant brown color corresponds to the CDOM category "River Mouth," while the blue color corresponds to "Far from Ice," a category meaning little to no CDOM presence. Interspersed are instances of "Harbor or Marina."

In general, the categories present in the limited set of images are qualitatively correct. They correspond to realistic water conditions present in and around the location. However, the actual values measured at the wharf are different from the model's predictions. On 27 October 2020, the model predicted a reference absorption of $\alpha_{440} = 0.26 \pm 0.05$ and a spectral slope of $s = 0.0078 \pm 0.004$. The values measured on the ground were $\alpha_{440} = 0.11$ and $s = 0.018$, a significant difference.

There are several factors that made drawing conclusions from the results difficult. First was the small number of samples available for comparison. Second, the closeness of the wharf to the shore meant that the satellite pixel

encompassing it includes part of the shoreline, which can affect the quality of the sensor data. Finally, the ground sample was only taken on the same day as the satellite image, not at the same instant, which introduces the possibility of changes occurring in the water between the ground sample and the satellite image.

Further study is needed to determine the effectiveness of this modeling method. The qualitative success on the satellite images and the general success on the lab-measured dataset imply that the methodology is sound, but that adjustments may be necessary to make it more accurate. Work is ongoing to evaluate this method's effectiveness using different satellites as well as more ground samples.

References

1. Michael Twardowski et al., "Modeling the spectral shape of absorption by chromophoric dissolved organic matter," *Marine Chemistry* vol. 89 (2004).

A Case for the Abolition of Polygyny in Morocco

Author: Lina Halim

PI: Rose McDermott (Brown University)

Field: Social Sciences

Abstract

This research paper will make a case for the abolition of the practice of polygyny[A] in Morocco. Firstly, this paper will outline the historical background of Morocco and its ties to the practice. This paper will give a religious background on the role and presence of polygamy in Islam and the consequent legislation in the Moroccan Moudawana. This will lead us to observe the consequences of polygyny on multiple factors affecting the well-being of women and children and the harm the practice is causing. This paper will then conclude that there are strong ties between violence against women and children and polygyny and argue for stricter law enforcement and eventually the ban of polygyny in Morocco.

Historical and Religious Background

The first Arab invasion in North Africa reached Morocco in the early part of the eighth century leading to the islamization of the Berbers population.[1] Multiple dynasties succeeded up to the period of European hegemony that led to a Franco/Spanish protectorate. Morocco gained independence in 1956 and adopted its first constitution in 1962. In the newly codified body of law supported by writings from the Quran and/or the Hadiths, Islam provides a basis for the continued values of Morocco and provides legitimacy to the developing universal structure of modern Morocco.[1]

A Polygyny is a form of polygamy when men have multiple wives in opposition to polyandry, when one women has multiple husbands. The words polygyny and polygamy will be used interchangeably, but only polygyny is legal in Morocco and is thus the only form discussed in this paper which focuses on Morocco.

With 93% of its population being considered religious, Islam is the majority and constitutionally established state religion in Morocco.[2] Including sharia law in its Penal Code is the government's commitment to the Moroccan nation's immutable values, the preservation and sustainability of which is entrusted to the King and the government, within the framework of an Islamic country. Marriage in Islam is a structure of stability and community.[3] The concept of polygamy existed long before Islam but was modified and reformed to allow two types of marriages: monogamous and limited polygynous.

Legislation Around Polygyny in Morocco

The document pertinent to the legislation of family law in Morocco is the Moudawana.[B] Starting in 1992, multiple women's right organizations launched a campaign for a reform of the Moudawana collecting over one million signatures for the prohibition of polygyny.[4] The eventual 2004 reforms mandated judges to investigate the celibacy of men and proof of their ability to provide equally for each household. Moreover, any man who wishes to take a second wife must get the approval of his first wife who can sue him in case of harm (in the form of violence, abandonment or non respect of marriage conditions of equality). Because of the changes in legislation, the practice of polygyny has been declining. In 1992, 5.1% of Moroccan women were in a polgynous marriage.[5] In 2008, only 0.27% of marriages were polygynous.[6]

According to the polygyny scale from the WomenStats[C] project by Professor Rose McDermott designed to code the prevalence and legal status of polygyny in a given state, Morocco scored 3. Which means that in 2010, polygyny was legal under customary/religious law, but less than 25% of women are in such arrangements.

B a legal document that governs the rights and duties pertaining to marriage, divorce, the custody of children, alimony, and inheritance

C The WomanStats Project began in 2001 with the aim of investigating the link between the security and behavior of states and the situation and security of the women within them. It is a team of researchers dedicated to the continual expansion of the WomanStats Database, as well as the pursuit of their research agenda assessing the relationship between the situation and security of women, and the dynamics between security, stability, and the behavior of the state. (http://www.womanstats.org)

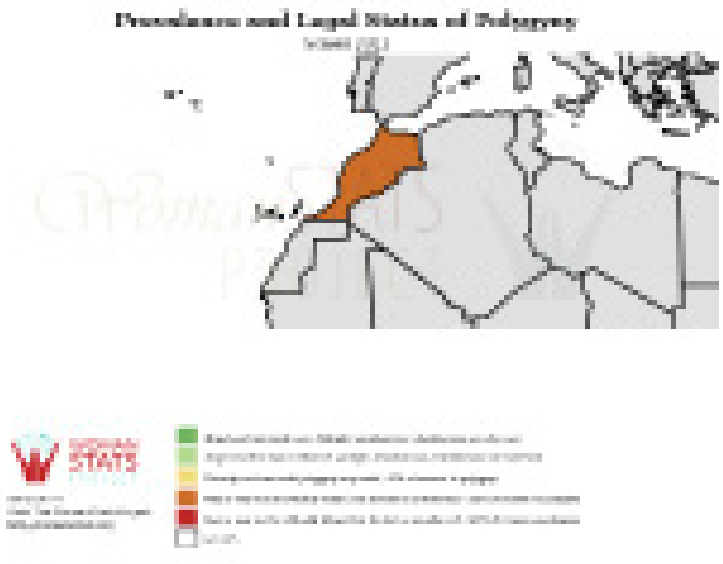

Figure 1: Prevalence and Legal Status of Polygyny in Morocco - WomanStats (n.d.)

The Consequences of Polygyny

This paper argues that violence toward women and children and the suppression of basic rights can be correlated to polygyny. The social structures around the practice encourages male control over women and children and endorses violence and repression of political rights and liberties. It imposes a family structure, economic system and limited reproductive rights and freedoms that hinder efforts made by Morocco to promote gender equality.

Polygyny promotes weaker and more superficial marital bonds by its very nature, if only because of limited attention and distraction. This then leads to higher matrimonial instability, making women in polygynous marriages six times more likely to divorce and remarry, often to the same man. Polygynous unions in Morocco are characterized by a strong age difference. In polygamous societies, child and adolescent brides are more likely than older brides to be second or third wives.[7] Births to younger mothers are much riskier and short interbirth intervals[D] raises risks for a myriad of maternal problems (McDermott). The decline in the phenomenon as rates of polygyny are also lowering indicates a strong correlation between these two factors.

D where children are born less than eighteen months apart

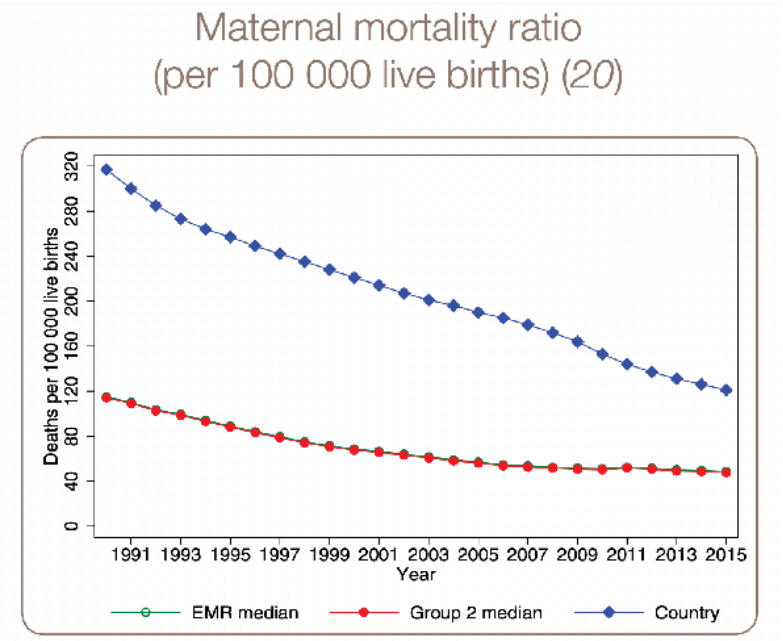

Figure 2: Maternal mortality ratio (per 100000 live births) - World Health Organization Regional Office for the Eastern Mediterranean Morocco health profile 2015

Because the decrease in polygyny appears to increase the age of marriage, it allows children to attend school longer. The limited amount of income per child in polygynous marriages allows less resources per child. Young children are thus forced to drop out of school to get status by enrolling in the military or provide income by marrying young or finding a job. As polygyny has been decreasing in Morocco, a very strong increase in girls' enrollment in schools can be observed: they now representing 47.2% of students in primary schools, an increase by 17.8 points since 1990.[8] There has also been a sharp increase in boys' enrollment bringing global enrollment in secondary school to 61% of all children up from 28.2% in the early 2000s.

Polygynous marriages normalize multiplicity of sexual partners for males which is the highest risk of sexually transmitted diseases transmission according to the Moroccan Ministry of Health. The HIV pandemic has had dangerous consequences for women, to the extent of a feminization of the disease. Over 42% of people with HIV are women, a quarter of them infected by their spouses.[9] Women in polygynous marriages are thus vulnerable.

Elevated frequency of polygynous marriages tends to be associated with increases in behavioral constraints and physical cost experienced by women and children in particular.10 According to the Moroccan High Commission for planning, in 2019, within the 3% of women married or engaged to a

polygynous spouse, more than half are victims of domestic violence (52.6%).[8] If the Moroccan government has been launching initiatives to decrease global rates of violence against women, it has failed acknowledge the compelling correlation with the practice of polygyny.

Conclusions

Polygyny's significance in fostering local and systemic violence against women and children, as well as its role in underpinning support for the repression of human rights and civil liberties, demands that measures should be made to better understand the ways in which, and the processes by which, polygyny fosters local and institutional violence against women and children. The evolution of these factors since the two reforms of the Moudawana indicate a possible correlation between the drop in the practice of polygyny and the decrease in propensity for male violence. With the decline in the practice of polygyny, we have observed a simultaneous decrease on birth rates and maternal mortality, an increase in girls and boys enrollment in schools, of age of marriage and longevity. Moreover, we have identified very high rates matrimonial instability, HIV rates and domestic violence within polygynous marriages. These findings require further study as they strongly suggest the significance of identifying polygyny as a source of harm that can be changed by effective legislative intervention. The social, cultural and institutional practices that support its existence manifest an impact that locks the status of women at a vulnerable state.

References

1. Hagopian, E. C. (1963). Islam and Society-Formation in Morocco Past and Present. *Journal for the Scientific Study of Religion*, 3 (1), 70–80. Retrieved from https://www.jstor.org/stable/1385007 (Publisher: [Society for the Scientific Study of Religion, Wiley]) DOI: 10.2307/1385007

2. Boissevain, K. (2010, December). El Ayadi Mohammed, Rachik Hassan, Tozy Mohamed, L'Islam au quotidien. Enquˆete sur les valeurs et les pratiques religieuses au Maroc, Casablanca, Prologues, coll : Religion et soci´et´e, 2007, 272 p. *Revue des mondes musulmans et de la M´editerran´ee*(128). Retrieved from http://journals.openedition.org/remmm/6560 (ISBN: 9782853997683 Number: 128 Publisher: Publications de l'Universit´e de Provence)

3. *The Concept of Polygamy and the Prophets Marriages* | Al-Islam.org. (n.d.). Retrieved from https:// www.al-islam.org/articles/concept-polygamy-and-prophets-marriages-sayyid-muhammad -rizvi

4. *Making Over the Moudawana: Legal Reform and Women's Rights in Morocco.* (2020, November). Retrieved from https://gareviewnyu .com/2020/11/25/making -over -the -moudawana -legal -reform-and-womens-rights-in-morocco/
5. Buskens, L. (2003). Recent Debates on Family Law Reform in Morocco: Islamic Law as Politics in an Emerging Public Sphere. *Islamic Law and Society*, 10 (1), 70–131. Retrieved from https:// www.jstor.org/stable/3399220 (Publisher: Brill)
6. Buskens, L. (2016, November). La polygamie au quotidien. Notes d'un observateur dans une maison pleine de femmes. In A. Boutaleb, B. Dupret, J.-N. Ferri´e, & Z. Rhani (Eds.), *Le Maroc au pr´esent : D'une ´epoque `a l'autre, une soci´et´e en mutation* (pp. 393–403). Maroc: Centre Jacques-Berque. Retrieved from http://books.openedition.org/cjb/1062 (Code: Le Maroc au pr´esent : D'une ´epoque `a l'autre, une soci´et´e en mutation)
7. *Maroc : ces polygames qui nous gouvernent. . . – Jeune Afrique*. (2015, May). Retrieved from https:// www.jeuneafrique.com/232317/societe/maroc-ces-polygames-qui-nous-gouvernent/ (Sec tion: News (General))
8. *Maroc - Taux de natalité brut (par 1000 habitants) | Statistiques*. (n.d.-a). Retrieved from https:// perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays/?codeStat=SP.DYN.CBRT .IN&codePays=MAR&codeTheme=1
9. *Maroc - Taux de natalité brut (par 1000 habitants) | Statistiques*. (n.d.-b). Retrieved from https:// perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays/?codeStat=SP.DYN.CBRT .IN&codePays=MAR&codeTheme=1
10. *WomanStats*. (n.d.). Retrieved from http://www.womanstats.org/new/view/
11. C., V., Crognier, E., Baali, A., Baudot, P., Bley, D., Bo¨etsch, G., & Hilali, M. K. (2014, January). Polygynie et f´econdit´e au Maroc : l'effet de l'instabilit´e matrimoniale. In *Conception, naissance et petite enfance au Maghreb* (pp. 105–112). Aix-en-Provence: Institut de recherches et d'´etudes sur les mondes arabes et musulmans. Retrieved from http:// books.openedition.org/iremam/2901 (Code: Conception, naissance et petite enfance au Maghreb)
12. Midech, J. (n.d.). *Polygamie au Maroc : les hommes continuent de ruser pour avoir une deuxi`eme femme*. Retrieved from https://www.lavieeco.com/societe/polygamie-au-maroc-les-hommes -continuent-de-ruser-pour-avoir-une-deuxieme-femme-24142/ (Section: Soci´et´e)

Darwinian vs. Teleological Accounts of Industrialization: Does Industrialization Separate Producers' Motivations from the Interests of Society?

Author: Hansae Lee

PI: Emily Skarbek, Political Theory Project, Brown University

Field: Social Sciences, Philosophy, Economics

Abstract

This paper evaluates Thorstein Veblen's theory that industrialization separates producers' motivations from the promotion of social good. I will begin by explaining Veblen's conception of human motivations, namely his theory that individuals are driven by both altruistic and self-interested motivations. With that in mind, I will explain Veblen's claim that pre-industrialization producers are primarily driven by altruistic motivations which promote social good, and that post-industrialization producers are primarily motivated by self-interest and profit maximization. I will evaluate this argument by challenging Veblen's Darwinian assumption (that human motivations are flexible) with the teleological view (that human motivations are fixed). In doing so, I will show that one may prefer the teleological view because it offers an explanation for what prompts industrialization itself.

Note: by no means is my summary of Veblen's arguments exhaustive of his view regarding my research question—in fact, Veblen develops a theory of "technological determinism" which offers reasonable responses to some of the objections I raise. I am simply describing Veblen's arguments as a starting point for the purposes of this paper.

Veblen's Theory of Human Motivations

Veblen agrees with orthodox economics as far as acknowledging that individuals are driven by self-interest (i.e, the promotion of one's own material benefit).

However, Veblen suggests that self-interest is not the only motivation driving humans.[1] *Parental instincts*, according to Veblen, refer to the motivation to promote the welfare of one's community (e.g, family, tribe, class, nation). *Workmanship instinct*s refer to the motivation to produce commodities that are of high quality and produce them efficiently. *Idle curiosity* refers to the motivation to continually ask questions and develop knowledge. Additionally, Veblen highlights that parental instincts motivate individuals to promote the social good *for the sake of the social good*. Conversely, workmanship instincts and idle curiosity are not inherently concerned with the social good, yet Veblen highlights that they both lead to consequences that benefit society. Thus, Veblen concludes that humans have motivations beyond self-interest: namely parental instincts, workmanship instincts, and idle curiosity which serve the social good (call these *altruistic* motivations).

The Effect of Industrialization on Motivations

With that in mind, Veblen considers how motivations determined producers' behavior in a pre-industrialization economy. A pre-industrialization economy was characterized as one where producers used their own labor and capital for production. Furthemore, they "produced commodities that gave expression to his instincts for workmanship and parenthood. The income derived from these activities was a fair measure of the effort exerted."[2] Veblen claims that production in a pre-industrialization economy allowed individuals to fully express their altruistic motivations. Thus, the income derived from these commodities was not earned out of self-interest, but rather as a byproduct of altruistic motivations. Therefore, Veblen concludes that pre-industrialization economies allowed individuals' altruistic motivations to determine their economic decisions, thereby aligning individuals' motivations with the promotion of the social good.

In contrast, Veblen argues that industrialization creates environments where individuals' self-interest takes over their altruistic motivations, thereby separating individuals' motivations from the interests of society. An industrialized economy is characterized by larger-scale capital intensive supply chains: producers no longer own the labor or materials which are used in production. Accordingly, since the labor of the producer (i.e, the owner of the firm) does not actively participate in much of the production, Veblen argues that producers are unable to fulfill their altruistic motivations, alluding to Marx's theory of alienation.

Consequently, producers' altruistic motivations are diminished and replaced by self-interest: "the acquisitive instinct overrode the instinct of workmanship and parenthood."[3] Accordingly, as producers' goals shift from efficient production to profit maximization, producers reduce output and raise price levels as a means to monopoly power. These consequences are detrimental to the social good because monopolies fail to reach allocative and productive efficiency. Thus, Veblen concludes that industrialization separates the motivations of individuals from the interests of society.

Assumptions in Veblen's Theory

Veblen's argument adopts the Darwinian assumption that the composition of human motivations is flexible and determined by one's environment: "as Veblen interpreted Darwin, evolution was a purely mechanical process by which living things developed over time in response to environmental circumstances."[4] That is to say, when an agent finds themselves with the means to fulfill a certain motivation, the strength of that motivation will naturally increase. For instance, Veblen claims that producers in a pre-industrialization economy—who have the best means to fulfill altruistic motivations—are primarily driven by altruistic motivations. Conversely, producers in an industrialized economy—who have the best means to fulfill self-interested motivations—are driven by self-interest. Thus, Veblen assumes that the composition of producers' motivations is determined by the structure of the economy.

Critique of Veblen's Theory

In the derivation of Veblen's Darwinian assumption, there is the psychological assumption that agents consistently act upon their strongest motivation. In response, one may reasonably highlight that an agent's motivation does not entail one's ability to *act upon* that motivation. Another necessary condition for action is that the agent's *means* to act. That is to say, an agent only acts if they have both the *motivation* and the *means* to act.

Therefore, one may object to Veblen by arguing that the differences in behavior between pre-industrialization and post-industrialization producers are not necessarily caused by differences in their motivations. Rather, one may suggest that agents' motivations are fixed, namely that producers are always driven by self-interest irrespective of economic structure. Accordingly, one may propose that post-industrialization producers are able to act in self-interest

(i.e, maximize profit), whereas pre-industrialization producers are not, simply because only the former has the means to do so (e.g, larger-scale supply chains, ability to build monopoly power). Thus, Veblen's Darwinian view seems unconvincing.

Reconsider the two plausible views concerning human motivation: Veblen's Darwinian claim that human motivations are flexible and determined by one's environment, and the competing claim that motivations are fixed. Although both views explain differences in behavior between pre-industrialization and post-industrialization producers, one may favor the latter view because it explains what *prompted* the industrial revolution. If one assumes that producers are always driven by self-interest and profit-maximization, it follows that pre-industrialization producers lack the means to fulfill their strongest motivation. Consequently, the industrial revolution may be viewed as producers' *attempt to gain* the means of production necessary for fulfilling their strongest, pre-existing, self-interested motivations. That is to say, the industrial revolution itself may be viewed as an economic decision motivated by producers' self-interest. Conversely, Veblen's Darwinian claim that motivations are determined by economic structure fails to explain why the economic structure itself changes. Accordingly, this gives rise to the teleological claim: economic structure is determined by individuals' motivations (i.e, the reversal of Veblen's Darwinian claim that individuals' motivations are determined by economic structure).

Conclusion

In conclusion, I have shown that Veblen's argument relies on the Darwinian assumption that producers' motivations are flexible and determined by the economic structure in which they operate. Veblen's argument successfully shows why unregulated industrialized economies do not benefit society, but fails to explain what prompted the industrial revolution itself. In response, I have proposed a teleological view: economic structure is determined by producers' motivations, and producers are always motivated by self-interest.

References

1. Veblen, Thornstein. *The Theory of Business Enterprise*. 1904.
[2] Landreth, Harry, and David C. Colander. *History of Economic Thought*. Houghton Mifflin, 2002. p.346.
[3] Landreth and Colander, p.346.
[4] Landreth and Colander, p.341.

Contraceptive Use of Adolescents and University Students in Canada

Author: Rachel Tam

PI: Matthew Gutmann (Brown University)

Field: Anthropology, Public Health/Public Policy

There are many contraceptive methods available today, including external condoms, internal condoms, patches, and oral contraceptives. However, not all are made equal. Many studies have concluded that the more user-dependent a protective method is, the lower the typical use effectiveness will be.[1] For example, the probability of condoms not being effective is much higher in the general population than in studies during which subjects were taught how to properly use a condom.

The contraceptive methods most effective at preventing pregnancy are LARCs (long-acting reversible contraceptives). LARCs consist of intrauterine devices (IUDs, also known as intrauterine contraception or IUC) and subdermal, progestin-releasing implants. Once inserted, these devices can be left in the body for multiple years before removal or replacement. Yet, according to the Canadian Contraception Consensus of 2015, only 4.6% of Canadian women between the ages of 15 to 24 use a LARC.[3] Why is the usage of the most effective type of contraception so low?

Some potential barriers to LARCs are prohibitive cost, limited clinic and provider accessibility, and lack of provider education.[2] One of the most obvious accessibility issues is the high cost of LARCs. An IUD can cost several hundred dollars, with an average price of $319 for a hormonal IUD.[3] This large up-front fee can be a significant deterrent for Canadian youth who might not be able to afford the IUD. Many studies have shown that when offered all methods of contraception for free, students will choose LARCs more than 66% of the

time.[2] The surge in LARC use when the cost is eliminated indicates that young Canadians understand the benefits of using a method of contraception that has higher effectiveness and will prioritize such methods with all other factors held constant.

An alternative solution would be to allow for the option of paying for LARCs in installments. When computing the annual prices of contraceptive methods, LARCs are some of the cheaper methods because of their lifespans of up to 5 years. For example, instead of paying an up-front fee of $319 for a hormonal IUD, perhaps patients could pay $63 per year. By comparison, oral contraceptives generally cost approximately $143 annually (13 units per year at $11 per unit).[4]

Additionally, many remote regions of Canada lack access to sufficient healthcare resources. When there are only a few physicians serving a community, it is challenging to reliably provide the medical attention and care needed to foster proper sexual health in young Canadians. Smaller provider pools also decrease the likelihood of finding a health care provider who is available and trained in how to insert and use LARCs.[3] One possible solution to the limitations of access to health care providers is to allow different types of qualified health care workers to be able to prescribe contraceptives and educate patients on their use.

One study surveyed pharmacists across Canada on their comfort level prescribing contraceptives and found that most were comfortable with that task, as long as they had the appropriate training. Enabling pharmacists to broadly prescribe contraceptives would bolster access, since most other prescribing professionals are located in large urban areas. Pharmacists, conversely, are frequently the most accessible health professionals in rural and remote regions.[5] As of 2020, pharmacists in four provinces - Alberta, Nova Scotia, Saskatchewan, and Quebec - are able to prescribe an assortment of contraceptives that vary by the province to clients.2 Thus, triaging patients in need of sexual health advice and contraceptives from physicians to nurse practitioners and pharmacists can improve the accessibility of reproductive health care across Canada. That being said, pharmacists and nurse practitioners need to be sufficiently educated prior to offering these sexual health services.

Despite the availability of a variety of contraceptive options, the Canadian health care system has much work to do to guarantee equitable access to effective contraception. In an ideal world, Canada would have universal pharmacare and all health care providers would do their best to create safe,

non-judgemental, private environments for patients to discuss their reproductive goals and sexual practices. However, a more realistic goal for Canada would be to allow pharmacists to prescribe contraceptives to patients in all provinces and territories. Recent policy prescriptions indicate that Canada is heading in the right direction: making contraceptives available to all.

References

1. Wilkes, S., Schick-Makaroff, K., O'Rourke,T., Eastlick Kushner, K. (2020). Use of Long-Acting Reversible Contraceptives Amongst Adolescents: An Integrative Review. *The Journal for Nurse Practitioners*, 16(8), 597-607. https://doi.org/10.1016/j.nurpra.2020.06.010.
2. Di Meglio, G., Crowther, C., Simms, J. (2018). Contraceptive care for Canadian youth, *Paediatrics & Child Health*, 23(4), 271–277, https://doi.org/10.1093/pch/pxx192
3. Di Meglio, G., & Yorke, E. (2019). Universal access to no-cost contraception for youth in Canada. *Paediatrics & Child Health*, 24(3), 160-164. doi: 10.1093/pch/pxz033
4. Norman, W. V., Soon, J. A., Panagiotoglou, D., Albert, A., Zed, J. Z. (2015). The acceptability of contraception task-sharing among pharmacists in Canada -- the ACT-Pharm study. *Contraception*, 92(2015), 55-61. http://dx.doi.org/10.1016/j.contraception.2015.03.013
5. Canadian Pharmacists Association. (2020). Community Pharmacists in Canada: Contraceptive Prescribing.

Spatially Coordinated Immune Evasion in Classical Hodgkin's Lymphoma

Authors: Nitya Thakkar

PI: Neriman Tokcan (Broad Institute of MIT and Harvard)

Field: Computational Biology

Classical Hodgkin's Lymphoma (CHL) is a cancer of the lymphatic system. While many cancers have homogenous tumor microenvironments, CHL tumors are unique in that they have a very diverse microenvironment of tumor cells - which compose less than 1% of the tumor volume - that are interspersed within a dense layer of immune cells. Previous studies have found that these tumor cells are dependent on the immune cells in the tumor microenvironment for survival and to modify their mechanisms of immune evasion. However, there is currently no standard treatment for CHL with a consistently low associated morbidity rate. Building on previous studies, we sought to develop new computational methods to identify immune cells and genes in the microenvironment that promote the survival of cancerous cells.

We first identified the cell types in spatial data by developing a new deep learning model, achieving an accuracy of 78.7%. Then, we aimed to determine potentially meaningful cellular and genetic relationships by creating new spatial analyses methods to identify cells in proximity to tumor cells. We found that dendritic cell density (cDC), which represents a major cell type in the tumor immune microenvironment and plays an essential role in cancer immunity, increases as distance to the nearest tumor cell decreases (Spearman's correlation: 0.991; p=1.43e-121). The downstream effect of this result is future therapies could target and kill cDC cells to indirectly cause cancerous cell death, which could lead to more precise and effective cancer treatments. Understanding which nonmalignant cells and genes enable the survival of tumor cells and their mechanisms of immune evasion could help reduce the morbidity rate of this cancer and be applied to other, similar cancers and diseases.

Improving Post-Processing on Video Object Recognition Using Inertial Measurement Unit

Authors: Zhiyuan Zhou, Spencer Boyum, Michael Paradiso

(Brown University)

Abstract

Videos are inherently full of temporal and spatial in- formation that suggests how objects in videos are moving through time. However, this spatial relationship between frames is rarely used in object recognition on videos. One can easily capture these kinds of spatial information with an Inertial Measurement Unit (IMU), a small electronic device that includes a gyroscope and accelerometer. In this paper, we propose two methods based on IMU measurements to enhance the accuracy of video object recognition in the post-processing phase. In this phase, we take the image-based object recognition result from each frame of the video, and apply a "confirmation module" over time. The "confirmation module" takes the spatial information into account and detects how the same object moves in the video frame with respect to time then use that detec- tion to strengthen the confidence of objects detected in the video and remove noisy detections.We make use of the Intersection over Union model and Kalman Filter as the two confirmation methods. Our methods achieve two main advantages: first, both methods are computationally cheap and can therefore be done on light-weight CPU-only devices; second, both methods are compatible with any image-based object recognition engine and can be applied widely. To evaluate our proposed methods, we collected a video dataset accompanied by IMU data and used available datasets online. We use You Only Look Once (YOLO) [5] as the base object-recognition engine. Our empirical re- sults show that both proposed methods can significantly in- crease recognition accuracy using the spatial acceleration data provided by IMU. The code for this paper is available at: https://github.com/zhouzypaul/object-recognition-imu

1. Introduction

In recent years, object recognition on images has achieved great success [5, 4, 10]. However, recognition on videos still remains a challenging task because of motion blur [8], occlusion [9], etc. Recent approaches in video object recognition mostly run image-based object recognition on every frame of the video [5]. However, this process is very time-consuming and doesn't take into account the tem- poral and spatial information of videos.

There are a lot of implicit connections between two adjacent frames in a video. For example, if a cat is in one frame, it should remain around the same pixel location in the next frame with high probability, because it can't have moved very far in one frame. This kind of temporal and spatial in- formation can be used to increase the accuracy by encour- aging true positives (ensuring the cat is still detected in the next frame) and discouraging false positives (discourage the detection of an airplane when it's not detected previously).

Object recognition typically consists of three stages: object proposal generation, object classification, and post- processing [1]. After the first two stages, an object recog- nition engine can return the detected objects with bounding boxes and confidence sores, the probability of the bounded object belonging to a certain class. In this paper, we propose two post-processing-stage methods to leverage the spatial and temporal information of videos to increase the accuracy of object recognition. The two methods are based on Intersection over Union and the Kalman Filter [2], respectively. Since our methods operate within the post-processing stage, they are compatible with all object recognition engines.

We capture the temporal information with frame rate and spatial information with an Inertial Measurement Unit (IMU), a device that measures linear acceleration and an- gular velocity. We propose to mount an IMU to the cam- era recording the video to capture the camera's movements through space. Here, we make the important assumption that objects in the video are close to having no movement, so their movement in the video is the reverse of that of the camera. This is a reasonable assumption for many indoor environments, and approximately holds true for most environments provided a high frame rate.

2. Methodology

2.1 Intersection over Union

Intersection over Union (IoU) is a commonly used metric for comparing shape similarity [6]. Mathematically, for two shapes A and B, IoU is defined as

$$IoU(A,B) = \frac{Area\ (A \cap B)}{Area\ (A \cup B)} \quad (1)$$

In object recognition, it can be used to determine how the proximity of two bounding boxes; the higher the IoU the closer the two boxes are. In this paper, we say box A and B are close if $IoU(A, B) > 0.6$.

At frame t and $t + 1$, the recognition engine returns bounding box set B_t, B_{t+1} and their respective confidence score set P_t, P_{t+1}. If any object o has bounding box $b_t \in B_t$ and $b_{t+1} \in Bt+1$ that satisfies

$$IoU(b_t, b_{t+1}) > 0.6$$

it means o has been detected in adjacent frames at a very similar pixel position. We therefore strengthen the detection results by increasing the confidence score at time $t + 1$ by

$$P_{t+1}(o) = \min(1, P_t(o) + 50\% * (1 - P_{t+1}(o)))$$

This process is repeated for every frame t, resulting in a sequence of enhanced detection results.

2.2. Kalman Filter

Kalman Filter (KF) is a specific kind of Hidden Markov Model that takes in a series of noisy measurements over time and smooths the noise to output more accurate re-

sults [2]. It repeats the process of "predict" and "update". For a specific state, "predict" uses the transition dynamic to predict the state at the next time step. The "update" step then updates the real state at the next time step to align with the predicted one, essentially taking a weighted average of the two.

The prediction step is modeled by:

$$x = F\,x + Bu \quad (2)$$

$$\mathrm{P} = \mathrm{F}\ \mathrm{P}\ \mathrm{F} > + \mathrm{Q} \quad (3)$$

where state vector x consists of the confidence scores of each detectable class, transition dynamics F specifies that all confidences increase by 20% at each-step, external control matrix B and control vector u represents the spatial displacements measured by IMU, prediction matrix P, and process noise covariance matrix Q is taken to be identity.

The update phase is done by moving the prediction x towards the actual observation with Kalman Gain K as the

Video	YOLO AP	IoU AP	KF AP
1	1.00	0.99	1.00
2	0.85	0.84	0.84
3	0.48	0.66	0.50
4	0.49	0.45	0.49
5	0.99	0.98	1.00
6	1.00	1.00	1.00
7	0.98	0.98	0.99
8	0.98	0.97	0.98
9	0.82	0.81	0.77
10	0.94	0.95	0.94
11	0.75	0.67	0.75
12	0.81	0.57	0.70
13	0.67	0.47	0.67
14	1.00	1.00	1.00
15	1.00	1.00	1.00

Table 1. Comparison of Average Precision scores on 15 video segments selected from the 3 datasets.

update weight:

$$S = HPH^{\top} + R \quad (4)$$
$$K = PH^{\top} S^{-1} \quad (5)$$
$$x = x + K(z - Hx) \quad (6)$$

The measurement function matrix H and observation noise covariance matrix R are both identity, and z is the observation vector.
By repeating "predict" and "update" steps at every frame, Kalman Filter increases the confidence of objects correctly detected and lower the confidence of objects falsely detected.

3. Experiments and Results

We use three datasets to evaluate the two proposed methods: ImageNet ILSVRC2015 dataset [7], a visual-inertial dataset [3], and a self-collected dataset of an indoor environment. All video data is segmented into 1 frame per second, which enables real-time video object recognition even on hardwares with low compute power. We use IMU Adafruit BNO055 to record the acceleration data and YOLO [5] as the object-recognition engine. We compare the object recognition results of the above datasets as processed by YOLO, YOLO + IoU, and YOLO + Kalman Filter.

First, We evaluate the results using Average Precision score [11], which evaluates a model's ability to pick up true positives and disregard false detection. Although the models aren't able to produce consistent increases (Table 1), they are both very effective at increasing the final confidence scores, as shown in the following experiments. The IoU model is extremely effective at increasing the

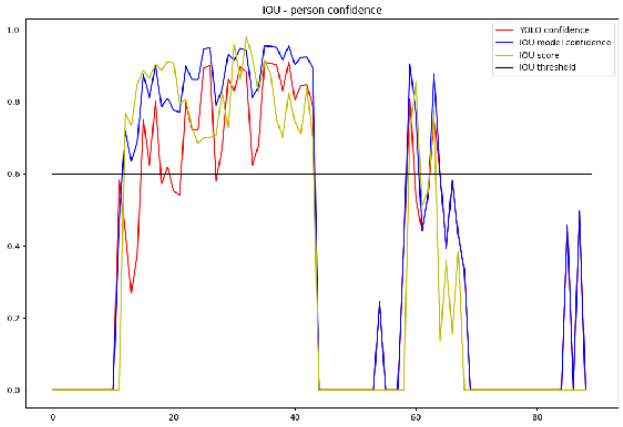

Figure 1. The IoU model with IMU recognizing a "person" in a video. When the IoU score is above the threshold (black), the confidence of the object gets increased from the original YOLO

detection confidence of true positives (Figure 1), and the increase heavily relies on the IoU scores over time.

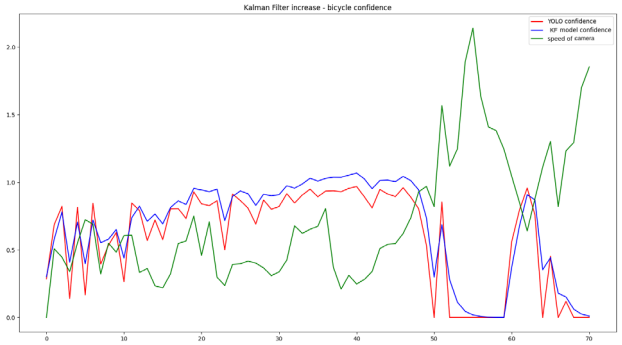

Figure 2. Recognition confidence of YOLO and the KF model of a "bicycle" in a video. Recognition confidence is low for both models when camera speed is large.

The effect of KF is similar to that of a noise filter. It can effectively reduce the variance of recognition confidences, smoothing out sudden changes in confidence scores that are caused by noise. Overall, we found that the use of IMU makes the result of a low frame rate video comparable to that of high frame rate ones. Both methods are effective at increasing true positives, although some false positives also emerge. The IoUmodel works better in smooth stable videos, while KF is better in dealing with sudden changes in videos. Both

operate fast enough to process low frame rate videos in real time, with the IoU model running at an average of 0.002 seconds per frame and the KF model 0.1.

4. Conclusion

This work presents two post-processing models of video object recognition using an IMU. They take into account a video's temporal and spatial information and show great promise in boosting the recognition confidences. It shows that an IMU can be used to lower video frame rate in object recognition tasks without losing performance, which can save significant computing power and time.

References

1. W. Han, P. Khorrami, T. L. Paine, P. Ramachandran, M. Babaeizadeh, H. Shi, J. Li, S. Yan, and T. S. Huang. Seq-nms for video object detection. *arXiv preprint arXiv*:1602.08465, 2016.
2. R. E. Kalman. A new approach to linear filtering and prediction problems. *Transactions of the ASME–Journal of Basic Engineering*, 82(Series D):35–45, 1960.
3. H. Ovrén and P.-E. Forssén. Spline error weighting for robust visual-inertial fusion. In *IEEE Conference on Computer Vision and Pattern Recognition*, Salt Lake City, Utah, USA, June 2018. Computer Vision Foundation. VR Project: Learnable Camera Motion Models, 2014-5928.
4. M. Radovic, O. Adarkwa, and Q. Wang. Object recognition in aerial images using convolutional neural networks. *Journal of Imaging*, 3(2):21, 2017.
5. J. Redmon, S. Divvala, R. Girshick, and A. Farhadi. You only look once: Unified, real-time object detection, 2015.
6. H. Rezatofighi, N. Tsoi, J. Gwak, A. Sadeghian, I. Reid, and S. Savarese. Generalized intersection over union: A metric and a loss for bounding box regression. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pages 658–666, 2019.
7. O. Russakovsky, J. Deng, H. Su, J. Krause, S. Satheesh, S. Ma, Z. Huang, A. Karpathy, A. Khosla, M. Bernstein, A. C. Berg, and L. Fei-Fei. ImageNet Large Scale Visual Recognition Challenge. *International Journal of Computer Vision (IJCV)*, 115(3):211–252, 2015.
8. C. Seibold, A. Hilsmann, and P. Eisert. Model-based motion blur estimation for the improvement of motion tracking. *Computer Vision and Image Understanding*, 160:45–56, 2017.
9. A. N. Stein and M. Hebert. Local detection of occlusion boundaries in video. *Image and Vision Computing*, 27(5):514–522, 2009.
10. D. P. Sudharshan and S. Raj. Object recognition in images using convolutional neural network. In *2018 2nd International Conference on Inventive Systems and Control (ICISC)*, pages 718–722. IEEE, 2018.
11. E. Zhang and Y. Zhang. *Average Precision*, pages 192–193. Springer US, Boston, MA, 2009.