Supplementary Material
Using Twitter to Track Immigration Sentiment During Early Stages of the COVID-19 Pandemic

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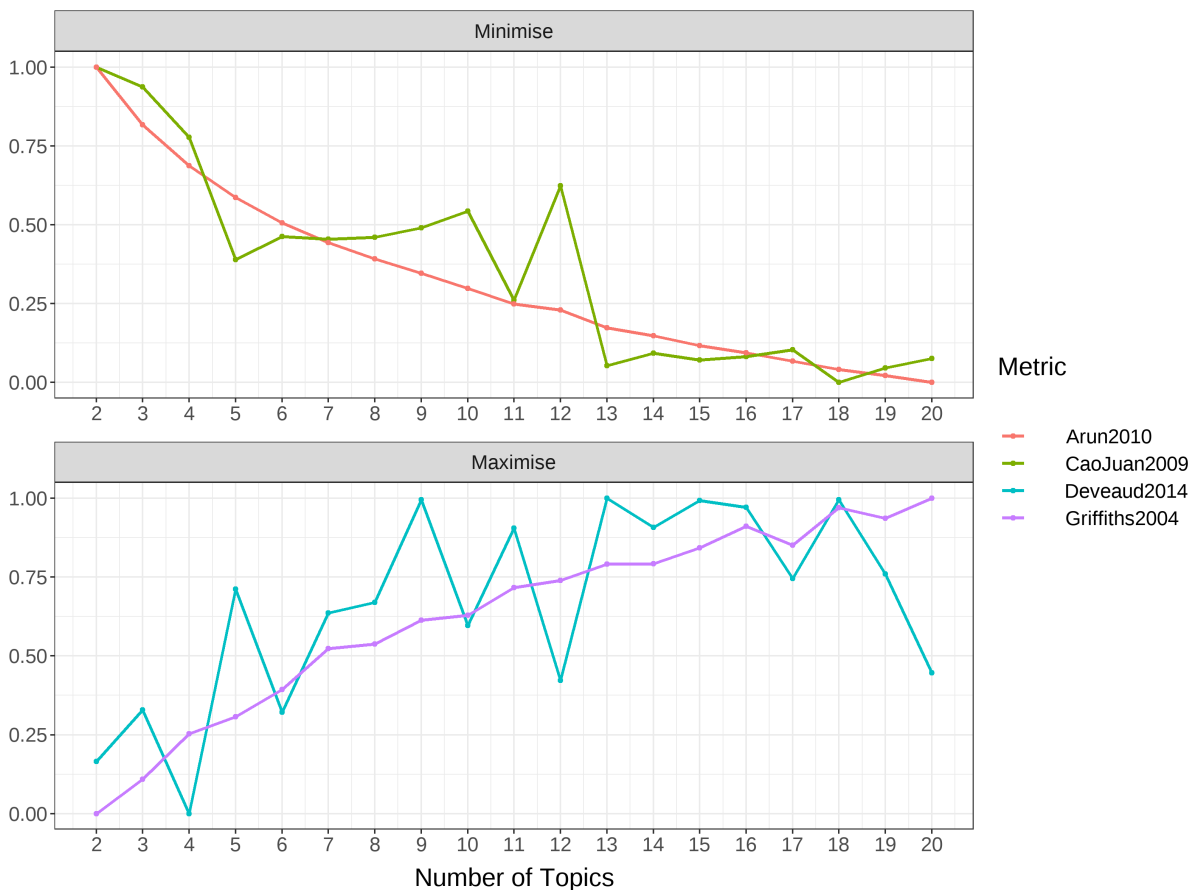*Corresponding author: Francisco Rowe (F.Rowe-Gonzalez@liverpool.ac.uk) ORCID: 0000-0003-4137-0246

Supplementary Tables

Supplementary Table 1. List of search terms used for our tweet data collection. Keywords, hashtags and Twitter user accounts were used. Twitter user accounts are not reported for confidentiality and privacy purposes.

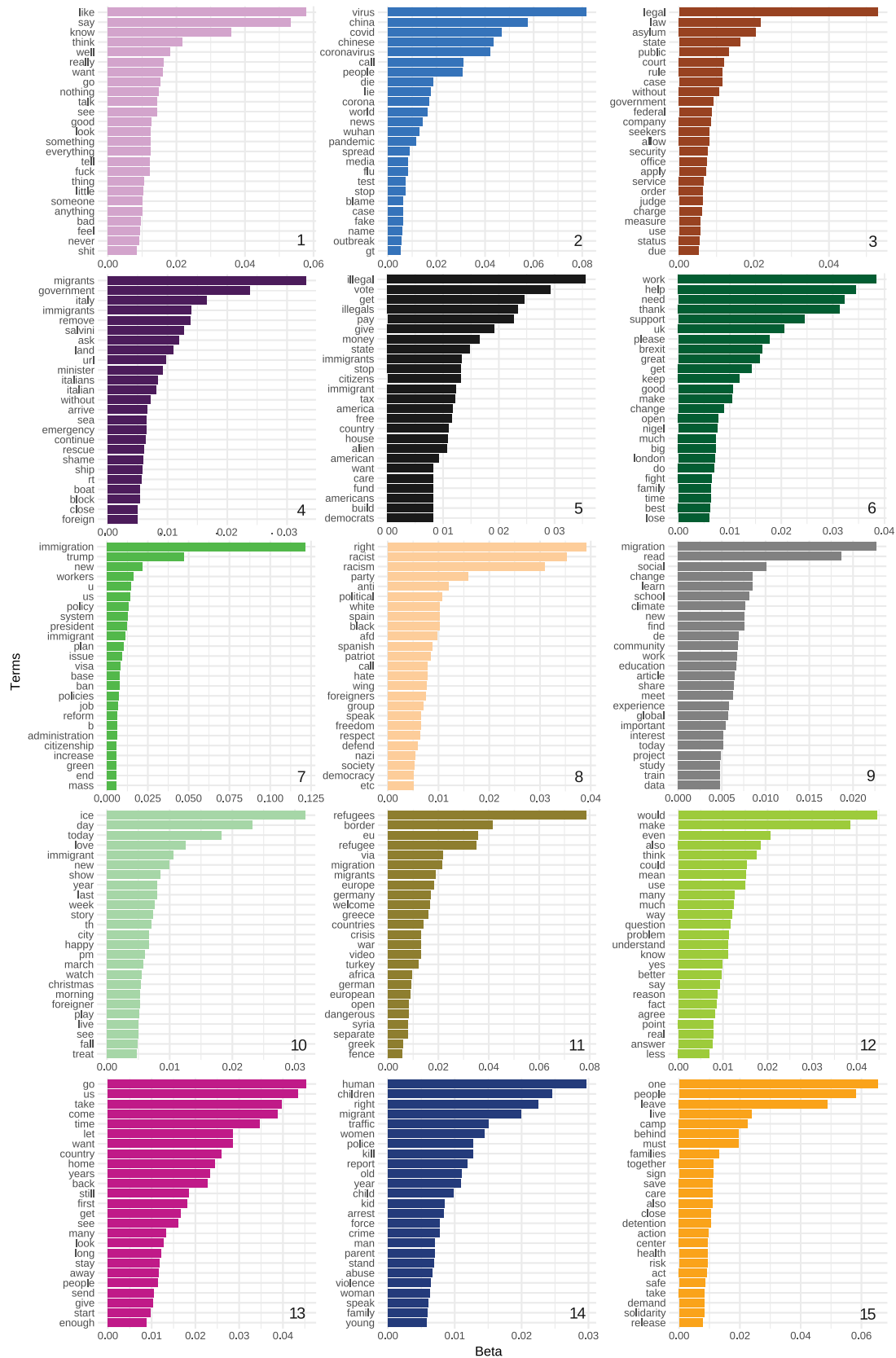| Countries	Categories		Search Terms
United Kingdom	Terms		immigrant, immigration, migrant, migration, "asylum seeker", refugee, "undocumented worker", "guest worker", "EU worker", "non-UK workers", "foreign worker", (human smuggling), (human trafficking), illegals, foreigner, "illegal alien", "illegal worker", islamophob*, sinophob*, "china flu", "kung flu", "china virus", "chinese virus", shangainese
	Accounts		37
	Hashtags	Positive	#RefugeesWelcome, #MigrantsWelcome, #LeaveNoOneBehind, #FreedomForImmigrants, #illegalmigantsUK, #LondonIsOpen, #EndHostileEnvironment, #FamiliesBelongTogether
		Neutral	#Pritiuseless, #migrationEU, #immigration, #migration, #immigrant, #migrant, #immigrate, #migrate, #refugees, #NigelFarage, #ImmigrationReform
		Negative	#illegals, #foreigner, #foreigners, #illegalalien, #illegalaliens, #illegalworker, #OurCountry, #illegalworkers, #KeepThemOut, #SendThemBack, #migrantsnotwelcome, #refugeesnotwelcome, #illegals, #ChinaVirus, #chinaflu, #kungflu, #chinesevirus, #TheyHaveToGoBack, #DeportThemAll
		Event	#Moria, #CampFire, #closethecamps
United States	Terms		immigrant, immigration, migrant, migration, "asylum seeker", refugee, "undocumented worker", "guest worker", "foreign worker", (human smuggling), (human trafficking), illegals, foreigner, "illegal alien", "illegal worker", islamophob, sinophob, "china flu", "kung flu", "china virus", "chinese virus", shangainese
	Accounts		37
	Hashtags	Positive	#RefugeesWelcome, #MigrantsWelcome, #LeaveNoOneBehind, #FreedomForImmigrants, #illegalmigantsUSA, #KillTheImmigrationBill, #ImmigrantsMakeAmericaGreat, #NoWall, #NoWallEver, #NoBan, #FamiliesBelongTogether, #stopICEcold, #EndRemainInMexico
		Neutral	#ICE, #immigration, #migration, #immigrant, #migrant, #immigrate, #migrate, #refugees, #ImmigrationReform
		Negative	#illegals, #foreigner, #foreigners, #illegalalien, #illegalaliens, #illegalworker, #illegalworkers, #KeepThemOut, #OurCountry, #SendThemBack, #migrantsnotwelcome, #refugeesnotwelcome, #illegals, #ChinaVirus, #chinaflu, #kungflu, #chinesevirus, #TheyHaveToGoBack, #DeportThemAll
		Event	#Moria, #closethecamps, #divestfromdetention
Spain	Terms		migraci, migrante, refugiad, migratorio, refugiada, discrimin, extranjer, xenofo, racista, deporta, legal, patriota, racismo, invasores, musulman, islamofobia, marroquí
	Accounts		36
	Hashtags	Positive	#InmigracionNoInvasion, #nomasdiscriminacion, #conlosrefugiados, #nohayserhumanoilegal, #multicultural, #bienvenidosaespana, #enddeportaciones
		Neutral	#Extranjería, #Inmigración, #Nacionalidad, #inmigrantes, #migrantes, #migración, #todossomosmigrante, #redmigrante, #migraciónlaboral, #leydemigración, #leydemigraciones, #migracionysalud, #migracionyeducacion, #migracionytrabajo, #migracionyeconomia, #soymigrante, #soymigranteandalucia
		Negative	#leymigratoriaya, #Quelosdeportenatodos, #DeportacionYa, #fueramigrantes, #cierrenfronteras, #NoMasMigrantes, #DeportacionInmediata, #inmigrantesilegales, #nomasinmigrantes, #TrataDePersonas, #TráficoIlícitodeMigrantes
		Event	#siria, #MoriaCamp, #lesbos
Italy	Terms		immigrato, immigrati, "richiedente asilo", "richiedenti asilo", "persona irregolare", "persone irregolari", migrante, migranti, straniero, stranieri, rifugiato, rifugiati, "vittima di tratta", "vittime di tratta", "minore non accompagnato", "minori non accompagnati", "traffico di migranti", sbarco, sbarchi, clandestino, clandestini, illegale, illegali, profugo, profughi, "immigrato abusivo", "immigrati abusivi", invasione, zingaro, zingari, negro, negri, negre, sporco, sporchi, scimmia, scimmie, extracomunitario, extracomunitari
	Accounts		59
	Hashtags	Positive	#portiaperti, #apriamoiporti, #aprireiporti, #accoglienza, #bastarazzismo, #fatelientrare, #SeaWatch, #SeaEye, #Openarms, #TuttiFratelli, #3ottobre, #restiamoumani, #regolarizzazione, #corridoiumanitari, #solidarieta, #dirittodiasilo, #ioaccolgo
		Neutral	#DecretiSicurezza, #decretoimmigrazione, #migranti, #migrazioni, #immigrati, #immigrazione, #SAR, #searchandrescue, #stranieri, #richiedentiasilo, #asilo, #rifugiati, #integrazione, #ONG, #iussoli, #decretiSalvini, #razzismo, #cittadinanza, #MareNostrum, #reinsediamento, #rimpatri, #Mediterraneo, #RegolamentoDublino, #hotspot, #tratta
		Negative	#portichiusi, #tolleranzazero, #descretisicurezza, #decretosalvini, #decretoimmigrazione, #BloccoNavale, #blocconavalesubito, #chiudiamoiporti, #invasione, #lamorgesedimettiti, #extracomunitari, #clandestini, #profughi, #irregolari, #ItaliaAgliItaliani, #aiutiamoliacasaloro, #primagliitaliani, #Decretoclandestini, #DifendiamolItalia, #iostoconSalvini
		Event	#Moria, #Etienne, #Abou, #Lesbo, #WillyMonteroDuarte, #WillyMonteiro
Germany	Terms		migrant, migranten, migrantin, migrantinnen, migrierende, migration, asylbewerber, asylbewerberin, asylbewerbende, flüchtling, flüchtende, flüchtlinge, "ausländische arbeiter", "ausländische arbeiterin", "ausländischer arbeiterinnen", gastarbeiter, gastarbeiterin, gastarbeiterinnen, "ausländische arbeitskräfte", "ausländische arbeitskraft", "illegale arbeiter", "illegale arbeiterin", "illegale arbeiterinnen", "illegal arbeitende", ausländer, ausländerin, ausländerinnen, zigeuner, zigeunerinnen, "kung flu", kanacken, kanacke, kanackin, kanackinnen
	Accounts		64
	Hashtags	Positive	#RefugeesWelcome, #MigrantsWelcome, #LeaveNoOneBehind, #FreedomForImmigrants, #BerlinIsOpen, #familyreunion, #wirschaffendas, #TogetherForRescue, #blacklivesmatter, #RescueFamily, #FightForSolidarity, #FreeTheShips, #WirHabenPlatz, #SafePassage, #FlattenTheBorders, #NotMyEU, #ShameOnYouEurope
		Neutral	#migration, #immigration, #immigrant, #migrant, #flüchtling, #flüchtlinge, #Asylrecht, #EUmigration, #Seenotrettung, #Migrationspakt, #MIgrationPact, #Migrationspaket, #Rückführungspatenschaft, #Asylreform
		Negative	#illegale, #ausländer, #Zigeuner, #KungFlu, #whitelivesmatter, #Kanacken, #MGGA, #Europistan, #Germanystan, #PEGIDA, #Zukunftheimat, #EinProzent, #ausländerraus, #keepthemout, #unserland, #migrantsnotwelcome, #refugeesunwelcome, #refugeesnotwelcome, #chinaflu, #chinavirus, #alleabschieben, #abschieben, #gegenmigration, #Befreiungvomislam
		Event	#Moria, #flüchtlingscamps, #campschliessung, #MoriaStory, #dreizehntausend, #Iuventa, #SeaWatch3, #Libyen, #RefugeesGR

Supplementary Figures

Supplementary Figure 1. Measures of model fit to assess the optimal number of topics based on distinctive clusters of tweets (Juan et al. 2009; Arun et al. 2010; Deveaud et al. 2014; Griffiths et al. 2004). Measures were normalised to one. When selected the number of topics for our model, we aimed to select the parsimonious solution. This required balancing the greater detail offered through more specific clusters with a higher number of clusters, as well as the ease of interpretation in having fewer clusters. We ran models for a range of solutions from two to 20 topics, comparing performance across four metrics which capture different aspects of model fit. A 15 topic solution was selected as the optimal solution. As described in Section 3.3. further analysis were conducted and topics were collapsed into 12 thematic areas.

References

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Juan C, Tian X, Jintao L, Yongdong Z, Sheng T. 2009. A density-based method for adaptive LDA model selection. *Neurocomputing — 16th European Symposium on Artificial Neural Networks* 2008 72, 7–9: 1775–1781.

Supplementary Figure 2. Top 25 frequent terms by topic.

Supplementary Figure 3. Per cent of tweets by topic, by positive and negative sentiment scores. Negative refers to scores < -0.05. Positive refers to scores above 0.05.