

Supplemental Materials for Candidate Choice 2020

Appendix A - Worst Performance ROC Comparison

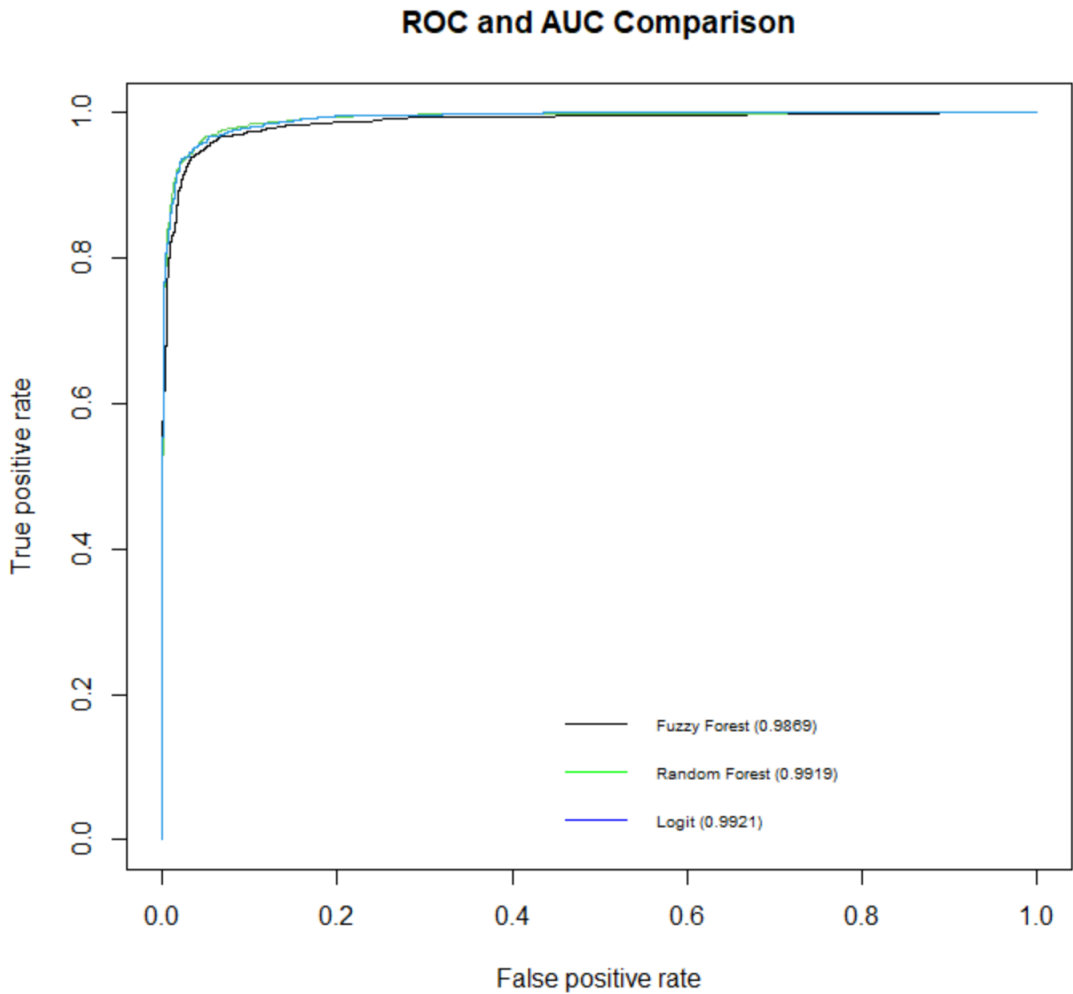


Figure 1: ROC curves and AUCs of the worst performing models from each cross validation.

Appendix B - Fuzzy Forest Hyperparameters

1. One of the most important hyperparameters for Fuzzy Forests is the *power*. A network with suspected scale-free topology is preferred for the algorithm, such that $c(z) \propto z^\theta$, where $c(z)$ is the frequency function for the connectivity and θ is non-negative real number (?). For networks in which this criterion holds, the power β ideally has a high R^2 between $\log(c(z))$ and $\log(z)$. Below is the scale-free topology plot for the data used in this study, which shows that power values of 2, 3, or 4 have a high R^2 , using a cutoff of 0.85. Of these, we chose *power* = 2.

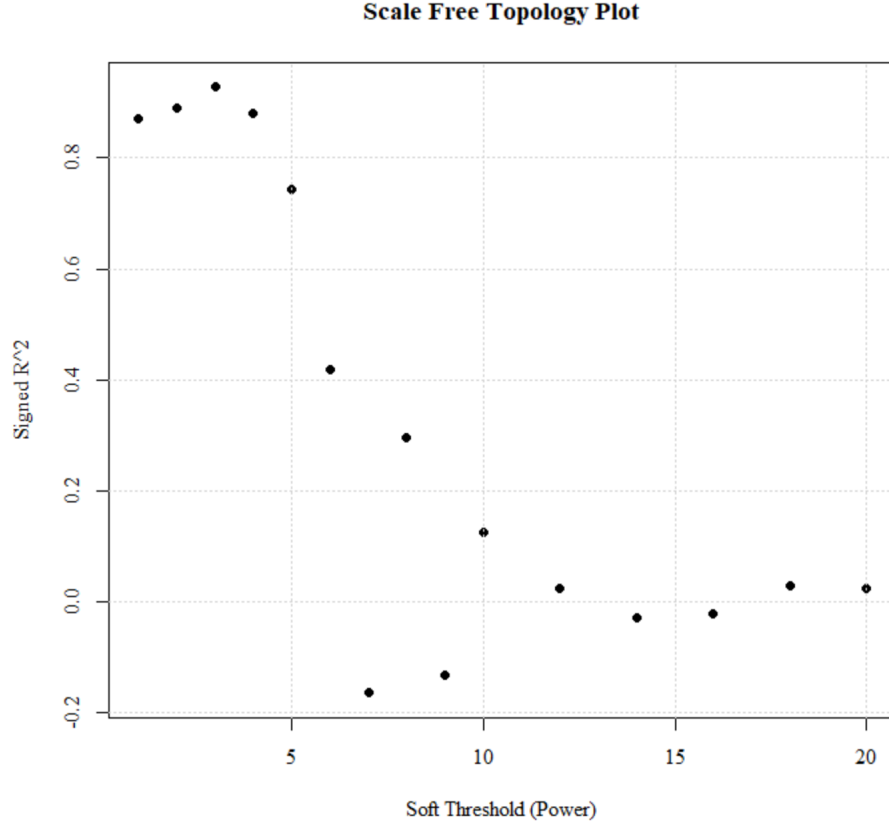


Figure 2: Analysis of the soft threshold for power needed to achieve a minimum R^2 scale free topology fit.

2. Another important hyperparameter is the minimum module size (*minModuleSize*), which determines the lowest amount of features per color. Since affirmative/negative versions of questions resulting from one-hot encoding consistently end up in the same module, we chose a *minModuleSize* of 5 to encourage at least two separate questions per module. This also prevents the formation of an excessive number of modules.
3. *dropfraction* is the proportion of features that are dropped during each round of RFE-RF, and the default value is 0.25. We optimized over two values: 0.25 and 0.50.

4. *keepfraction* is the proportion of features from each module that are to be kept during the screening step. The default value is 0.05, but our dataset is much smaller than biological ones, so we chose a value of 0.25.
5. The *mtryfactor* is a multiplier for *mtry*, which is passed into Random Forests. Since the number of features in each module is different, *mtry* is $(p/3) * mtryfactor$, where *p* is the number of features, or parameters, in the module. We used a value of 5 in *screening_params*, and 10 in *select_params*.
6. *min_ntree* is the minimum number of trees grown in each random forest; we set this to 1000.
7. *ntree_factor* is a Random Forest hyperparameter where *ntree_factor* multiplied by the number of parameters is the *ntree*. We use the default value of 1.

Appendix C - Full Module Membership and CES Feature List

In this Appendix we provide the full module membership and CES feature list in seven separate tables. The first column of each table provides the feature name from the CES 2020 dataset. The second column gives a longer description of the feature. The third column gives the model feature — for those features that were one-hot encoded. The fifth column provides responses to the CES question, while the sixth column gives the module that the CES feature is placed into by the Fuzzy Forests model.

CES Feature	Feature Label	Model Feature	Response	Module
birthyr	Year of Birth	birthyr	numeric	green
CC20_300_1	Used social media in the past 24 hrs	CC20_300_1.1 CC20_300_1.2	yes no	pink pink
CC20_300_2	Watched TV News in the past 24 hrs	CC20_300_2.1 CC20_300_2.2	yes no	pink pink
CC20_300_3	Read a newspaper in print or online in the past 24 hrs	CC20_300_3.1 CC20_300_3.2	yes no	grey grey
CC20_300_4	Listened to a radio news program or talk radio	CC20_300_4.1 CC20_300_4.2	yes no	grey grey
CC20_300_5	none of the these	CC20_300_5.1 CC20_300_5.2	yes no	pink pink
CC20_302	Over the past year, the nation's economy has gotten:	CC20_302.1 CC20_302.2 CC20_302.3 CC20_302.4 CC20_302.5 CC20_302.6	gotten much better gotten somewhat better stayed about the same gotten somewhat worse gotten much worse not sure	turquoise grey grey grey turquoise grey
CC20_303	Over the past year, has your household income:	CC20_303.1 CC20_303.2 CC20_303.3 CC20_303.4 CC20_303.5	increased a lot increased somewhat stayed about the same decreased somewhat decreased a lot	grey grey grey grey yellow
CC20_305_1	Over the past year, have you gotten married?	CC20_305_1.1 CC20_305_1.2	yes no	black black
CC20_305_10	Over the past year, have you visited an emergency room?	CC20_305_10.1 CC20_305_10.2	yes no	black black
CC20_305_11	Over the past year, have you visited a doctor for a regular exam?	CC20_305_11.1 CC20_305_11.2	yes no	black black
CC20_305_12	Over the past year, have you received a raise at work?	CC20_305_12.1 CC20_305_12.2	yes no	green green
CC20_305_13	Over the past year, have you had a pay cut at work?	CC20_305_13.1 CC20_305_13.2	yes no	purple purple
CC20_305_2	Over the past year, have you lost a job?	CC20_305_2.1 CC20_305_2.2	yes no	yellow yellow
CC20_305_3	Over the past year, have you finished school?	CC20_305_3.1 CC20_305_3.2	yes no	grey grey
CC20_305_4	Over the past year, have you retired?	CC20_305_4.1 CC20_305_4.2	yes no	green green
CC20_305_5	Over the past year, have you divorced?	CC20_305_5.1 CC20_305_5.2	yes no	grey grey
CC20_305_6	Over the past year, have you had a child?	CC20_305_6.1 CC20_305_6.2	yes no	grey grey
CC20_305_7	Over the past year, have you taken a new job?	CC20_305_7.1 CC20_305_7.2	yes no	yellow yellow
CC20_305_9	Over the past year, have you been a victim of a crime?	CC20_305_9.1 CC20_305_9.2	yes no	grey grey
CC20_307	Do the police make you feel:	CC20_307.1 CC20_307.2 CC20_307.3 CC20_307.4	mostly safe somewhat safe somewhat unsafe mostly unsafe	turquoise grey turquoise grey
CC20_309a_1	Have you been diagnosed with Covid-19 in the past year?	CC20_309a_1.1 CC20_309a_1.2	yes no	grey grey
CC20_309a_2	Has a family member been diagnosed with Covid-19 in the past year?	CC20_309a_2.1 CC20_309a_2.2	yes no	red red
CC20_309a_3	Has a friend been diagnosed with Covid-19 in the past year?	CC20_309a_3.1 CC20_309a_3.2	yes no	red red
CC20_309a_4	Has a coworker been diagnosed with Covid-19 in the past year?	CC20_309a_4.1 CC20_309a_4.2	yes no	red red
CC20_309a_5	No one you know has been diagnosed with Covid-19 in the past year:	CC20_309a_5.1 CC20_309a_5.2	yes no	red red
CC20_309c_1	My work hours have been reduced because of Covid:	CC20_309c_1.1 CC20_309c_1.2	yes no	purple purple
CC20_309c_10	Nothing about my work has changed due to Covid:	CC20_309c_10.1 CC20_309c_10.2	yes no	grey grey
CC20_309c_2	My work hours have been reduced because of Covid, but restored:	CC20_309c_2.1 CC20_309c_2.2	yes no	grey grey
CC20_309c_3	I have been temporarily laid off because of Covid:	CC20_309c_3.1 CC20_309c_3.2	yes no	yellow yellow
CC20_309c_4	I was temporarily laid off due to Covid, but I've been rehired:	CC20_309c_4.1 CC20_309c_4.2	yes no	grey grey

CC20_309c_5	I had more than one job before the pandemic, and I lost one of them:	CC20_309c_5.1 CC20_309c_5.2	yes no	grey grey
CC20_309c_6	I lost my job due to Covid:	CC20_309c_6.1 CC20_309c_6.2	yes no	yellow yellow
CC20_309c_7	I was not working when the pandemic began:	CC20_309c_7.1 CC20_309c_7.2	yes no	grey grey
CC20_309c_8	My hours have increased as a result of Covid:	CC20_309c_8.1 CC20_309c_8.2	yes no	green green
CC20_309c_9	I have taken additional jobs since the pandemic:	CC20_309c_9.1 CC20_309c_9.2	yes no	grey grey
CC20_309e	Would you say that, in general, your health is:	CC20_309e.1 CC20_309e.2 CC20_309e.3 CC20_309e.4 CC20_309e.5	excellent very good good fair poor	grey grey grey grey grey
CC20_327a	Expansion of Medicare to a single comprehensive public health care coverage program that would cover all Americans:	CC20_327a.1 CC20_327a.2	support oppose	turquoise turquoise
CC20_327b	Allow the government to negotiate with drug companies to get a lower price on prescription drugs that would apply to both Medicare and private insurance. Maximum negotiated price could not exceed 120% of the average prices in 6 other countries:	CC20_327b.1 CC20_327b.2	support oppose	grey grey
CC20_327c	Lower the eligibility age for Medicare from 65 to 50:	CC20_327c.1 CC20_327c.2	support oppose	turquoise turquoise
CC20_327d	Repeal the entire Affordable Care Act:	CC20_327d.1 CC20_327d.2	support oppose	turquoise turquoise
CC20_327e	Restore the Affordable Care Act's mandate that all individuals be required to purchase health insurance:	CC20_327e.1 CC20_327e.2	support oppose	turquoise turquoise
CC20_327f	Allow states to import prescription drugs from other countries:	CC20_327f.1 CC20_327f.2	support oppose	grey grey
CC20_330a	Prohibit state and local governments from publishing the names and addresses of all gun owners:	CC20_330a.1 CC20_330a.2	support oppose	turquoise turquoise
CC20_330b	Ban assault rifles:	CC20_330b.1 CC20_330b.2	support oppose	turquoise turquoise
CC20_330c	Make it easier for people to obtain concealed-carry permit:	CC20_330c.1 CC20_330c.2	support oppose	turquoise turquoise
CC20_332a	Always allow a woman to obtain an abortion as a matter of choice:	CC20_332a.1 CC20_332a.2	support oppose	turquoise turquoise
CC20_332b	Permit abortion only in case of rape, incest or when the woman's life is in danger:	CC20_332b.1 CC20_332b.2	support oppose	turquoise turquoise
CC20_332c	Prohibit all abortions after the 20th week of pregnancy:	CC20_332c.1 CC20_332c.2	support oppose	turquoise turquoise
CC20_332d	Allow employers to decline coverage of abortions in insurance plans:	CC20_332d.1 CC20_332d.2	support oppose	turquoise turquoise
CC20_332e	Prohibit the expenditure of funds authorized or appropriated by federal law for any abortion:	CC20_332e.1 CC20_332e.2	support oppose	turquoise turquoise
CC20_332f	Make abortions illegal in all circumstances:	CC20_332f.1 CC20_332f.2	support oppose	grey grey
CC20_332g	Prohibit states from requiring that abortions be performed only at hospitals (not clinics):	CC20_332g.1 CC20_332g.2	support oppose	grey grey
CC20_356	How do you feel about Amy Coney Barrett as Supreme Court Justice?	CC20_356.1 CC20_356.2 CC20_356.3	support oppose not sure	turquoise turquoise grey
CC20_356a	Should Ruth Bader Ginsberg be replaced:	CC20_356a.1 CC20_356a.2 CC20_356a.3	before new govt. in Jan. 2021 after new govt. in Jan. 2021 not sure	turquoise turquoise grey
CC20_360	With which party, if any, are you registered?	CC20_360.1 CC20_360.2 CC20_360.3 CC20_360.4	no party, Independent, declined to state Democratic Party Republican Party Other	grey turquoise turquoise grey

CC20_361	How long have you lived at your present address?	CC20_361.1 CC20_361.2 CC20_361.3 CC20_361.4 CC20_361.5 CC20_361.6	<1 month 2-6 months 7-11 months 1-2 years 3-4 years 5+ years	grey grey grey grey grey grey
CC20_363	Do you intend to vote in the 2020 general election on Nov. 3?	CC20_363.1 CC20_363.2 CC20_363.3 CC20_363.4 CC20_363.5 CC20_363.6	yes, definitely probably already voted plan to vote before Nov. 3 no undecided	grey grey grey grey grey grey
CC20_401	Did you vote in the 2020 general election on Nov. 3?	CC20_401.4 CC20_401.5	attempted, but did/could not definitely	grey grey
CC20_403	How did you vote:	CC20_403.1 CC20_403.2 CC20_403.3 CC20_403.4	in person on election day in person before election day voted by mail don't know	grey grey turquoise grey
CC20_411_GA1	Which candidate do you prefer (Georgia runoff election for Senate)?	CC20_411_GA1.1 CC20_411_GA1.2 CC20_411_GA1.7 CC20_411_GA1.97	Jon Ossoff David Perdue not sure other	grey grey grey grey
CC20_420_1	Deployment of US troops to ensure oil supply:	CC20_420_1.1 CC20_420_1.2	support oppose	brown brown
CC20_420_2	Deployment of US troops to destroy a terrorist camp:	CC20_420_2.1 CC20_420_2.2	support oppose	brown brown
CC20_420_3	Deployment of US troops to intervene in region with genocide/civil war:	CC20_420_3.1 CC20_420_3.2	support oppose	brown brown
CC20_420_4	Deployment of US troops to assist the spread of democracy:	CC20_420_4.1 CC20_420_4.2	support oppose	brown brown
CC20_420_5	Deployment of US troops to protect allies under attack:	CC20_420_5.1 CC20_420_5.2	support oppose	brown brown
CC20_420_6	Deployment of US troops to help the UN uphold intl. law:	CC20_420_6.1 CC20_420_6.2	support oppose	turquoise turquoise
CC20_420_7	Don't support troop deployment for any of the above:	CC20_420_7.1 CC20_420_7.2	support oppose	brown brown
CC20_421r	Tax increase-spending cut scale, to fix deficit spending	CC20_421r	numeric	turquoise
CC20_422r	Income tax-sales tax scale if state were to increase taxes	CC20_422r	numeric	grey
CC20_430a_1	Attended local political meetings in the past year?	CC20_430a_1.1 CC20_430a_1.2	yes no	blue blue
CC20_430a_2	Put up a political sign in the past year?	CC20_430a_2.1 CC20_430a_2.2	yes no	blue blue
CC20_430a_3	Worked for a candidate or campaign in the past year?	CC20_430a_3.1 CC20_430a_3.2	yes no	blue blue
CC20_430a_4	Attended a political protest, march, or demonstration in the past year?	CC20_430a_4.1 CC20_430a_4.2	yes no	blue blue
CC20_430a_5	Contacted a public official in the past year?	CC20_430a_5.1 CC20_430a_5.2	yes no	blue blue
CC20_430a_6	Donated money to a candidate, campaign, or political org. in the past year?	CC20_430a_6.1 CC20_430a_6.2	yes no	blue blue
CC20_430a_7	Donated blood in the past year?	CC20_430a_7.1 CC20_430a_7.2	yes no	grey grey
CC20_430a_8	Did not do any of the above in the past year?	CC20_430a_8.1 CC20_430a_8.2	yes no	blue blue
CC20_431a	Contacted by a candidate/campaign during 2020 elections?	CC20_431a.1 CC20_431a.2	yes no	blue blue
CC20_432a	Ever ran for elective office at any level of government?	CC20_432a.1 CC20_432a.2	yes no	grey grey
CC20_433a	Generally speaking, do you think of yourself as a:	CC20_433a.1 CC20_433a.2 CC20_433a.3 CC20_433a.4	Democrat Republican Independent other	turquoise turquoise grey grey
CC20_440a	White people in the U.S. have certain advantages because of the color of their skin:	CC20_440a.1 CC20_440a.2 CC20_440a.3 CC20_440a.4 CC20_440a.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise grey grey grey turquoise

CC20_440b	Racial problems in the U.S. are rare, isolated situations:	CC20_440b.1 CC20_440b.2 CC20_440b.3 CC20_440b.4 CC20_440b.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise turquoise grey grey turquoise
CC20_440c	Women seek to gain power by getting control over men:	CC20_440c.1 CC20_440c.2 CC20_440c.3 CC20_440c.4 CC20_440c.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	grey grey grey grey turquoise
CC20_440d	Women are too easily offended:	CC20_440d.1 CC20_440d.2 CC20_440d.3 CC20_440d.4 CC20_440d.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	grey turquoise grey grey turquoise
CC20_441a	Irish, Italians, Jewish and many other minorities overcame prejudice and worked their way up. Blacks should do the same without any special favors:	CC20_441a.1 CC20_441a.2 CC20_441a.3 CC20_441a.4 CC20_441a.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise grey grey turquoise turquoise
CC20_441b	Generations of slavery and discrimination have created conditions that make it difficult for Blacks to work their way out of the lower class:	CC20_441b.1 CC20_441b.2 CC20_441b.3 CC20_441b.4 CC20_441b.5	strongly agree somewhat agree neither agree nor disagree somewhat disagree strongly disagree	turquoise grey grey grey turquoise
CC20_442a	Assassination of Iranian General Qasem Soleimani:	CC20_442a.1 CC20_442a.2	support oppose	turquoise turquoise
CC20_442b	Withdraw the United States from the Iran Nuclear Accord and reimpose sanctions on Iran:	CC20_442b.1 CC20_442b.2	support oppose	turquoise turquoise
CC20_442c	Declare a national emergency to permit construction of border wall with Mexico:	CC20_442c.1 CC20_442c.2	support oppose	turquoise turquoise
CC20_442d	Suspend a program that allows migrants to remain in the US while their asylum cases were being decided:	CC20_442d.1 CC20_442d.2	support oppose	turquoise turquoise
CC20_442e	Withdraw troops from Kurdish-controlled region of northern Syria on the border with Turkey:	CC20_442e.1 CC20_442e.2	support oppose	turquoise turquoise
CC20_443_1	State legislature spending on welfare should:	CC20_443_1.1 CC20_443_1.2 CC20_443_1.3 CC20_443_1.4 CC20_443_1.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise turquoise grey grey turquoise
CC20_443_2	State legislature spending on healthcare should:	CC20_443_2.1 CC20_443_2.2 CC20_443_2.3 CC20_443_2.4 CC20_443_2.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise grey turquoise grey grey
CC20_443_3	State legislature spending on education should:	CC20_443_3.1 CC20_443_3.2 CC20_443_3.3 CC20_443_3.4 CC20_443_3.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise grey turquoise grey grey
CC20_443_4	State legislature spending on law enforcement should:	CC20_443_4.1 CC20_443_4.2 CC20_443_4.3 CC20_443_4.4 CC20_443_4.5	greatly increase slightly increase maintain slightly decrease greatly decrease	turquoise grey grey turquoise turquoise
CC20_443_5	State legislature spending on transportation/infrastructure should:	CC20_443_5.1 CC20_443_5.2 CC20_443_5.3 CC20_443_5.4 CC20_443_5.5	greatly increase slightly increase maintain slightly decrease greatly decrease	grey grey grey grey grey
cit1	Are you a US citizen?	cit1.1 cit1.2	yes no	grey grey

[illegible]

		inputstate.26 inputstate.27 inputstate.28 inputstate.29 inputstate.30 inputstate.31 inputstate.32 inputstate.33 inputstate.34 inputstate.35 inputstate.36 inputstate.37 inputstate.38 inputstate.39 inputstate.40 inputstate.41 inputstate.42 inputstate.44 inputstate.45 inputstate.46 inputstate.47 inputstate.48 inputstate.49 inputstate.50 inputstate.51 inputstate.53 inputstate.54 inputstate.55 inputstate.56	Michigan Minnesota Mississippi Missouri Montana Nebraska Nevada New Hampshire New Jersey New Mexico New York North Carolina North Dakota Ohio Oklahoma Oregon Pennsylvania Rhode Island South Carolina South Dakota Tennessee Texas Utah Vermont Virginia Washington West Virginia Wisconsin Wyoming	grey grey
internethome	What best describes your Internet access at home:	internethome.1 internethome.2 internethome.3	cable, DSL, other broadband dial-up none	grey grey grey
investor	Do you have any money invested in the stock market right now?	investor.1 investor.2	yes no	blue blue
marstat	What is your marital status?	marstat.1 marstat.2 marstat.3 marstat.4 marstat.5 marstat.6	married separated divorced widowed never married domestic/civil partnership	grey grey grey grey grey grey
newsint	Would you say you follow what's going on in govt. and public affairs:	newsint.1 newsint.2 newsint.3 newsint.4 newsint.7	most of the time some of the time only now and then hardly at all don't know	blue grey grey grey grey
numchildren	How many children do you have?	numchildren.0 numchildren.1 numchildren.2 numchildren.3 numchildren.4 numchildren.5 numchildren.6 numchildren.7 numchildren.8 numchildren.9 numchildren.10 numchildren.11 numchildren.12 numchildren.13 numchildren.14 numchildren.15 numchildren.16 numchildren.22 numchildren.25	none	grey 1 grey 2 grey 3 grey 4 grey 5 grey 6 grey 7 grey 8 grey 9 grey 10 grey 11 grey 12 grey 13 grey 14 grey 15 grey 16 grey 22 grey 25 grey
ownhome	Do you own your home or pay rent?	ownhome.1 ownhome.2 ownhome.3	own rent other	grey grey grey

pew_churatd	How often do you attend religious services (not weddings/funerals)	pew_churatd.1 pew_churatd.2 pew_churatd.3 pew_churatd.4 pew_churatd.5 pew_churatd.6 pew_churatd.7	more than once a week once a week once or twice a month a few times a year seldom never don't know	grey grey grey grey grey turquoise grey
pew_religimp	How important is religion in your life?	pew_religimp.1 pew_religimp.2 pew_religimp.3 pew_religimp.4	very important somewhat important not too important not at all important	turquoise grey grey turquoise
presvote16post	Who did you vote for in the 2016 presidential elections?	presvote16post.1 presvote16post.2 presvote16post.3 presvote16post.4 presvote16post.5 presvote16post.6 presvote16post.7	Hillary Clinton Donald Trump Gary Johnson Jill Stein Evan McMullin other did not vote for president	turquoise turquoise grey grey grey grey grey
race	What racial or ethnic group best describes you?	race.1 race.2 race.3 race.4 race.5 race.6 race.7 race.8	White Black or African-American Hispanic or Latino Asian or Asian-American Native American two or more races other Middle Eastern	grey grey grey magenta grey grey grey grey
**religpew	What is your present religion, if any?	religpew.1 religpew.2 religpew.3 religpew.5 religpew.9 religpew.10 religpew.11 religpew.12 religpew.97	Protestant Roman Catholic Mormon Jewish Atheist Agnostic nothing in particular something else Eastern/Greek Orthodox, Hindu, Buddhist, Muslim	grey grey grey grey grey grey grey grey grey
same_day	Does your state allow same-day voter registration?	same_day.0 same_day.1	yes no	grey grey
sexuality	Which of the following best describes your sexuality?	sexuality.1 sexuality.2 sexuality.3 sexuality.4 sexuality.5 sexuality.6	heterosexual/straight lesbian/gay woman gay man bisexual other prefer not to say	grey grey grey grey grey grey
union	Are you a member of a labor union?	union.1 union.2 union.3	yes formerly not now nor in the past	grey grey grey
urbancity	How would you describe the place where you live?	urbancity.1 urbancity.2 urbancity.3 urbancity.4 urbancity.5	city suburb town rural area none	grey grey grey grey grey