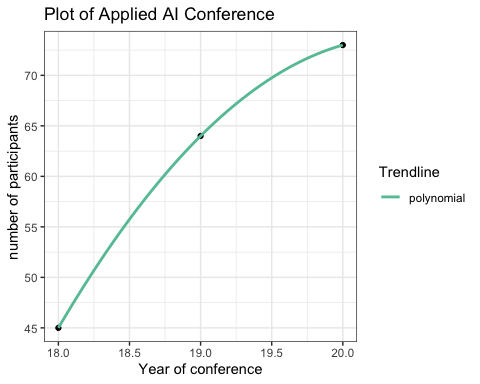
Trend analysis of diversity in conferences

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## population

library("readxl")  
aoolied\_file <- read\_excel("/Users/ricayang/Desktop/applied\_race.xlsx")  
applied\_ai\_x <- aoolied\_file$year  
applied\_ai\_y <- aoolied\_file$total  
library("ggplot2")  
DF <- data.frame(applied\_ai\_x, applied\_ai\_y)  
  
ggplot(DF, aes(x = applied\_ai\_x, y = applied\_ai\_y)) +  
 geom\_point() + ggtitle("Plot of Applied AI Conference") +  
 scale\_x\_continuous(name="Year of conference") +  
 scale\_y\_continuous(name="number of participants")+  
 stat\_smooth(method = 'lm', formula = y ~ poly(x,2), aes(colour = 'polynomial'), se= FALSE) + theme\_bw() +  
 scale\_colour\_brewer(name = 'Trendline', palette = 'Set2')



aaai\_file <- read\_excel("/Users/ricayang/Desktop/aaai\_race.xlsx")  
aaai\_x <- aaai\_file$year  
aaai\_y <- aaai\_file$total  
  
DF2 <- data.frame(aaai\_x, aaai\_y)  
ggplot(DF2, aes(x = aaai\_x, y = aaai\_y)) +  
 geom\_point() + ggtitle("Plot of AAAI Conference") +  
 scale\_x\_continuous(name="Year of conference", limits=c(2013, 2020)) +  
 scale\_y\_continuous(name="number of participants")+  
 stat\_smooth(method = 'lm', formula = y ~ poly(x,2), aes(colour = 'polynomial'), se= FALSE) + theme\_bw() +  
 scale\_colour\_brewer(name = 'Trendline', palette = 'Set2')

A close up of a map

Description automatically generated



For AAAI conference, due to the loss of data of all other participants except chairs and invited speakers in 2018, considering the incomplete data in 2018 as an outlier and exclude it from the analysis. There is an increasing trend of attendees in the AAAI conference from 2013 to 2020. AAAI, as a long-history academia conference, although the conferences mainly held in USA, there are a large group of committees every year from different places. Among participants in AAAI, there are only about 2% participants from Asia in 2013, while in 2020 there is at least 18% participants from Asia, and the other group of participants, for example, participants from North America, Europe and Oceania keeps constant.

For Applied AI conference, a newly industry conference, the number of participants is increasing through 2018 to 2020. Since it is more likely that an industry conference shows regional concentration trend, the conference is holding at 1 city in 2018, 6 cities in 2020, and going to be 11 cities in 2021. With the increasing number of participated cities, the degree of diversity of this conference can be proved.

Overall, the conferences in artificial intelligence field are having increasing attendees through these years, and more and more companies are participating, not only from different areas but different universities and companies. Therefore, taking the increasing population into account, conferences in artificial intelligence field are becoming more diverse through these years.

## Proportion

## Applied AI conference

I used the two-proportions z-test to compare two observed proportions.

Null hypothesis :

Alternative hypothesis :

where is the proportion of female in the 2018 Applied AI conference, is the proportion of female in the 2020 Applied AI conference.

pwr.2p2n.test(h = 0.2, n1 = 45, n2 = 74, sig.level = NULL, power = 0.8)  
## difference of proportion power calculation for binomial distribution (arcsine transformation)   
##   
## h = 0.2  
## n1 = 45  
## n2 = 74  
## sig.level = 0.6618683  
## power = 0.8  
## alternative = two.sided  
##   
## NOTE: different sample sizes

x <- factor(X18\_file$gender,levels=c("male","female"), labels=c(0,1))  
y <- factor(X20\_file$gender,levels=c("male","female"), labels=c(0,1))  
prop.test(x = c(sum(x == 1),sum(y == 1)), n = c(45,74), alternative = "greater",conf.level = 0.34)

##   
## 2-sample test for equality of proportions with continuity correction  
##   
## data: c(sum(x == 1), sum(y == 1)) out of c(45, 74)  
## X-squared = 0.88282, df = 1, p-value = 0.1737  
## alternative hypothesis: greater  
## 34 percent confidence interval:  
## 0.1170556 1.0000000  
## sample estimates:  
## prop 1 prop 2   
## 0.3555556 0.2567568

Conducting power analysis on the two sample, using significance level 0.66 can be enough to detect some difference. Since p-value < , there is enough evidance to reject null hypothesis with a 0.66 significance level, which suggests that the proportion of female in this conference is statistically different from 2018 to 2020, which means I am 34% confident that the true value of is in between 0.12 and 1.

## AAAI conference

Null hypothesis :

Alternative hypothesis :

where is the proportion of female in the 2013 AAAI conference, is the proportion of female in the 2020 AAAI conference, and my significance level is 0.1

x <- factor(X13\_aaai\_file$gender,levels=c("male","female"), labels=c(0,1))  
y <- factor(X20\_aaai\_file$gender,levels=c("male","female"), labels=c(0,1))  
aaai\_trend <- prop.test(x = c(sum(x == 1),sum(y == 1)), n = c(720,6581), alternative = "less",conf.level = 0.9)  
## 2-sample test for equality of proportions with continuity correction  
##   
## data: c(sum(x == 1), sum(y == 1)) out of c(720, 6581)  
## X-squared = 9.6894, df = 1, p-value = 0.0009267  
## alternative hypothesis: less  
## 90 percent confidence interval:  
## -1.00000000 -0.03191394  
## sample estimates:  
## prop 1 prop 2   
## 0.1861111 0.2385656

Since p-value < , there is enough evidance to reject null hypothesis, which suggests that the proportion of female in this conference is statistically different from 2013 to 2020, and the proportion of female is increasing through the years. And I am 90% confident that the true value of is in between 0.031 and 1.

# same year comparsion

x <- factor(X18\_aaai\_file$gender,levels=c("male","female"), labels=c(0,1))  
y <- factor(X18\_file$gender,levels=c("male","female"), labels=c(0,1))  
year18\_trend <- prop.test(x = c(sum(x == 1),sum(y == 1)), n = c(113,45), alternative = "less",conf.level = 0.9)  
year18\_trend

##   
## 2-sample test for equality of proportions with continuity correction  
##   
## data: c(sum(x == 1), sum(y == 1)) out of c(113, 45)  
## X-squared = 1.9929, df = 1, p-value = 0.07902  
## alternative hypothesis: less  
## 90 percent confidence interval:  
## -1.000000000 -0.005348504  
## sample estimates:  
## prop 1 prop 2   
## 0.2300885 0.3555556

x <- factor(X19\_aaai\_file$gender,levels=c("male","female"), labels=c(0,1))  
y <- factor(X19\_file$gender,levels=c("male","female"), labels=c(0,1))  
year19\_trend <- prop.test(x = c(sum(x == 1),sum(y == 1)), n = c(3457,64), alternative = "less", conf.level = 0.9)  
year19\_trend

##   
## 2-sample test for equality of proportions with continuity correction  
##   
## data: c(sum(x == 1), sum(y == 1)) out of c(3457, 64)  
## X-squared = 2.7329, df = 1, p-value = 0.04915  
## alternative hypothesis: less  
## 90 percent confidence interval:  
## -1.00000000 -0.01419927  
## sample estimates:  
## prop 1 prop 2   
## 0.2597628 0.3593750

x <- factor(X20\_aaai\_file$gender,levels=c("male","female"), labels=c(0,1))  
y <- factor(X20\_file$gender,levels=c("male","female"), labels=c(0,1))  
year20\_trend <- prop.test(x = c(sum(x == 1),sum(y == 1)), n = c(6581,74), alternative = "less", conf.level = 0.9)  
year20\_trend

##   
## 2-sample test for equality of proportions with continuity correction  
##   
## data: c(sum(x == 1), sum(y == 1)) out of c(6581, 74)  
## X-squared = 0.051942, df = 1, p-value = 0.4099  
## alternative hypothesis: less  
## 90 percent confidence interval:  
## -1.00000000 0.05406878  
## sample estimates:  
## prop 1 prop 2   
## 0.2385656 0.2567568

With a 0.1 confedence level , comparing conference in the same 3 year, the proportion of female in AAAI conference is always smaller than the proportion of female in Applied AI conference in 2018 and 2019. However, in 2020, p-value is larger than , which means there is not a statistically difference between the proportion of female of two conferences in 2020. Gender diversity is equitable or fair representation of people of different genders. It most commonly refers to an equitable ratio of men and women, the result of the same year comparison tells that the proportion of female is increasing these years, who contributes to the gender diversity of conference in artificial intelligence field.

## Race

Categorizing participants’ likely race/ethnicity according to US Census taxonomy: W\_NL (white, non latino), HL (hispano latino), A (asian, non latino), B\_NL (black, non latino).

Below showing the trend line of race ratio in different conference. For AAAI conference, the number of Asian is increasing dramatically from 2013 to 2020, and the number of black, non latino also showing an increasing trend. While the percentage of White, non latino is decreasing significantly, the percentage of hispano latino is slightly decreasing. Adding a 0.25 reference line, assume that if each line approach 0.25 more, the participant composition of race for the conference is more equal. The ratio of Asian and White nearly composite the main part of participants (each above 0.25) For Applied AI conference, the number of hispano in increasing while the black, non hispano in decreasing and Asian and White, non latino dominate the participants through 2018 to 2020. We can see that there might be some issues in the race distribution of the two conference through these years.

A close up of a map

Description automatically generated

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Description automatically generated

In order to know is there a statistically difference race distribution between years of different conference, Using Chi-Square test of independence, assuming 0.1 significance level.

Ho: participants in each year and race are independent.

Ha: participants in each year and race are not independent.

# aaai\_race\_dif  
tulip2 <- c(210,63,111,333)  
res2 <- chisq.test(tulip2, p = c(4907/6578,645/6578,451/6578,575/6578))  
res2

##   
## Chi-squared test for given probabilities  
##   
## data: tulip2  
## X-squared = 1441.8, df = 3, p-value < 2.2e-16

# applied\_race\_dif  
tulip <- c(22, 3,1, 19)  
ind\_res <- chisq.test(tulip, p = c(36/73, 1/73, 8/73,28/73))

## Warning in chisq.test(tulip, p = c(36/73, 1/73, 8/73, 28/73)): Chi-squared  
## approximation may be incorrect   
## Chi-squared test for given probabilities  
##   
## data: tulip  
## X-squared = 12.528, df = 3, p-value = 0.005778

Because of p-value < , race distribution and conference in different year are statistically significantly associated.

Now using Chi-Square goodness of fit test to compare multiple observed proportions to expected probabilities. If these races were equally distributed, the expected proportion would be 1/4 for each of the race.

Ho: There is no significant difference between the observed and the expected value.

Ha: There is a significant difference between the observed and the expected value.

# applied\_ai\_dif  
tulip <- c(22, 3,1, 19)  
equal\_res <- chisq.test(tulip, p = c(1/4,1/4,1/4,1/4))  
equal\_res

##   
## Chi-squared test for given probabilities  
##   
## data: tulip  
## X-squared = 31, df = 3, p-value = 8.5e-07

# aaai\_race\_dif  
tulip2 <- c(210,63,111,333)  
eq\_res2 <- chisq.test(tulip2, p = c(1/4,1/4,1/4,1/4))  
eq\_res2

##   
## Chi-squared test for given probabilities  
##   
## data: tulip2  
## X-squared = 238.53, df = 3, p-value < 2.2e-16

The p-value of both tests are less than the significance level alpha = 0.1. We can conclude that the races are significantly not commonly distributed and there is a significant difference between the observed and the expected value.

Overall, in terms of diversity of conference in the artificial intelligence field, the population and gender part are becoming more diverse, while there some inequality in race distribution through these conference from 2013 to 2020 .