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Problem Chosen

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**2017**
**MCM/ICM**
**Summary Sheet**
(Your team's summary should be included as the first page of your electronic submission.)

## Summary

dklfjalsk

**Keywords:** a, b, c, d

# This is a template

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## Contents

# 1 INTRODUCTION

## *1.1 Problem Analysis*

TODAY,information has many channels to spread and to be recieved.

Specifically, we face five subproblems:

- Develop one or more model(s) to explore the flow of information and filter;
- Validate the models' reliability by using data from the past and the prediction capability of the model to predict the information communication situation for today and compare that with today's reality;
- Use the model to predict the communication networks' relationships and capacities around the year 2050;
- Use the theories and concepts of information influence on networks to model how public interest and opinion can be changed through information networks in today's connected world;
- Determine how information value, people's initial opinion and bias, form of the message or its source, and the topology or strength of the information network in a region, country, or the world could be used to spread information and influence public opinion.

## *1.2 Our work*

We consider that the problems are progressive , which contributes to solve the main problem. To analyze the relationship between speed/flow of information versus inherent value of information of 5 periods and solve all problems, we should firstly know the basic definitions and how dissemination work. Then, we should make clear its development over time relative to its scale, spreading speed and impact. Subsequently, we discuss how to changed people's mind through the Internet and how the dissemination of information. Finally, we make a brief conclusion of models, apply them to some "What if" problems and summarize the whole passage.

# 2 Assumptions

- Three roles take part in the dissemination of news:source, media and individual.
- Different types of roles' impact vary from one from another, while in a same type, different nodes' impact vary from one to another.
- The dissemination of information is with randomicity.
- The size of a node shows its impact.
- A line represents a two-way propagation. Each time, the direction of propagation depends on which node has greater influence.

# 3 Data Analysis

# 4 Problem 1

## 4.1 Assumptions

- Three roles take part in the dissemination of news:source, media and individual.
- Different types of roles' impact vary from one from another, while in a same type, different nodes' impact vary from one to another.
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- A line represents a two-way propagation. Each time, the direction of propagation depends on which node has greater influence.

## 4.2 Model1

**Analyse**

The WS model in Small-world Network and the BA model Scale-free Network partly reveal some features of a network of communication such as its topology.

The WS Model emphasizes the relationship of pairs of nodes and their reconnections.

**Model Establishment**

**Verification**

## 4.3 The Results

# 5 Problem 2

## 5.1 Assumptions

- Three roles take part in the dissemination of news:source, media and individual.
- Different types of roles' impact vary from one from another, while in a same type, different nodes' impact vary from one to another.
- The dissemination of information is with randomicity.
- The size of a node shows its impact.
- A line represents a two-way propagation. Each time, the direction of propagation depends on which node has greater influence.

## 5.2 *Model1*

**Analyse**

The WS model in Small-world Network and the BA model Scale-free Network partly reveal some features of a network of communication such as its topology.

The WS Model emphasizes the relationship of pairs of nodes and their reconnections. To show the randomness, the WS Model add its paths randomly to a previous one, and derive as NW Model. The degree of nodes are similar due to its building way. Unfortunately, its nodes will never increase by time and each added path doesn't have any preference. That is, we can consider all nodes in a same scale in this model actually.

The BA Model pays attention on a "preferable"

**Model Establishment**

**Verification**

- $N$ :The number of factors.
- $m$ :The number of periods.
- $n$ :The length of time.

A raw fuction is:

$$y = \frac{1}{K + ab^t} \tag{10}$$

where

$$K > 0, a > 0, 0 < b \neq 1$$

Then,

$$y_t^{'} = K + ab^t \tag{11}$$

We thus obtained their arguments from:

$$\begin{cases} b = & \left(\frac{S_3 - S_2}{S_2 - S_1}\right)^{\frac{1}{m}} \\ a = & (S_2 - S_1)\frac{b-1}{b(b^m-1)^2} \\ K = & \frac{1}{m} \end{cases} \tag{12}$$

where

$$S_1 = \sum_{t=1}^{m} y_t^{'}, S_2 = \sum_{t=m+1}^{2m} y_t^{'}, S_3 = \sum_{t=2m+1}^{3m} y_t^{'} \tag{13}$$

In this model, we consider five periods from 1920s to 2010s. $n$ is 90 while $m$ is 5.

In this model, some parameters can be defined as:

$$input = \sum_{i=1}^{3} input(i) \tag{21}$$

$$hidden : n = \sqrt{\sum_{i=1}^{3} input(i) + 4} \tag{22}$$

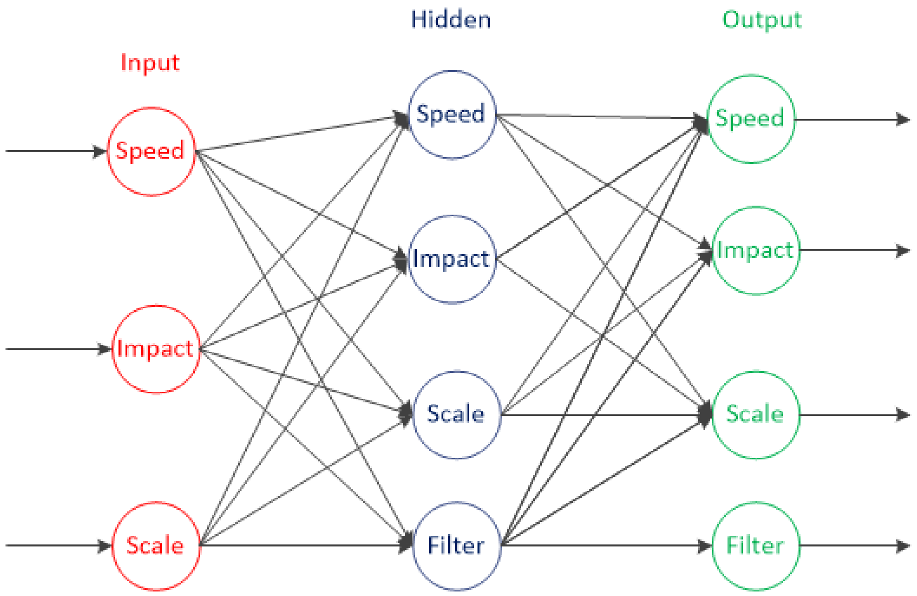


Figure 1: A initial BP Model

where $i$ is shenjingyuanshuliang.

$$output(j) = \sum_{j=1}^{4} func\,(n) \tag{23}$$

where $func(x)$ is a function calculating the influence of $n$.

## 5.3 The Results

We access some data from the Internet and make the average value as shown below:

Then ,we put them into our modified model, and get the result as:

Where the solid line the real data and the singles points are generated by the modified model.

To confirm its capability of predicting, we use the $MSE, SSE, RMSE$ to measure the prediction model. The measure of the prediction error is shown in $Table2$. As a matter of fact it

| Items | 1870s | 1920s | 1970s | 1990s | 2010s |
|---|---|---|---|---|---|
| RI (years) | 80 | 70 | 50 | 20 | 20 |
| OS (hours) | 72 | 5 | 2 | 0.5 | 0.17 |
| RS (hours) | 158 | 48 | 24 | 3 | 0.5 |
| RT (hours) | 42 | 65 | 112 | 158 | 187 |

Table 1: Data obtained through the Internet

| Items | MSE | SSE | RMSE |
|---|---|---|---|
| RI | 40.4496 | 40.4496 | 6.3600 |
| SS (hours) | 0.0121 | 0.0121 | 0.1100 |
| RT (hours) | 111.7249 | 111.7249 | 10.5700 |

Table 2: Data through the Internet

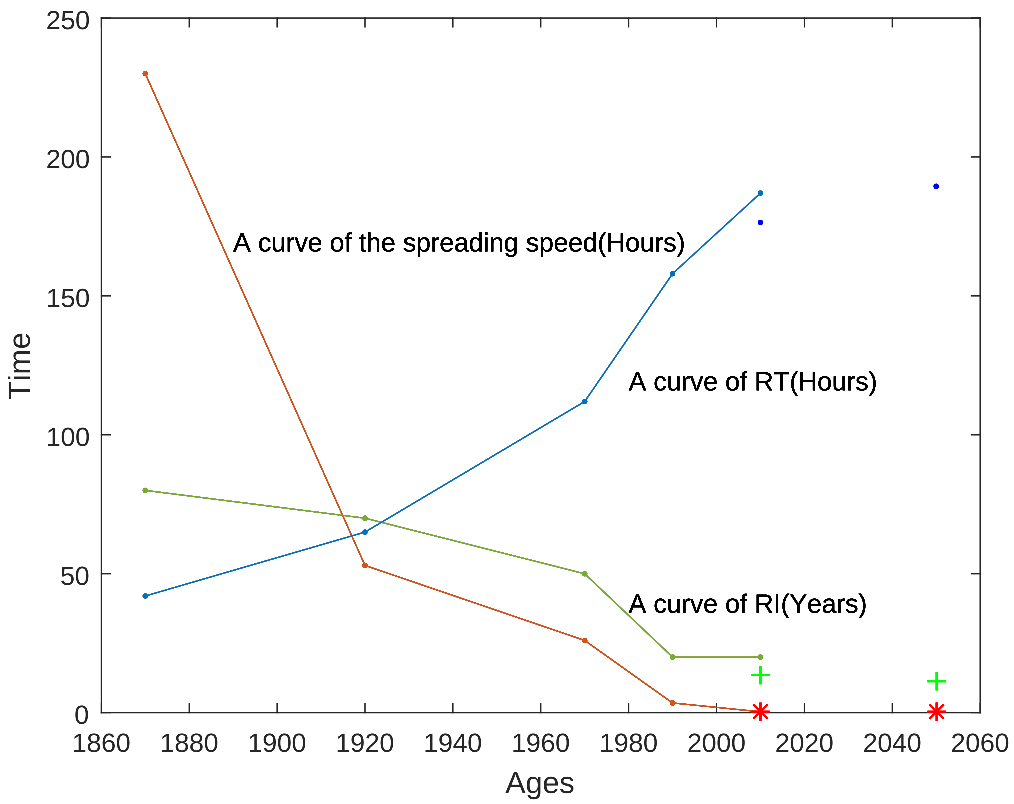


Figure 2: The results

doesn't seem to work,it tells nothing. We consider it's a result of the poor scale of data.

### *Extends*

Refer to the impact a dissemination network brings, we should consider in different periods, different devices show them in different ways. We find some data which reveals the impact of different periods of different devices as below:

# 6 CONCLUSIONS

**Strengths**

- Applies widely
- **The models possess practicability and value of popularization**
- From the perspective of as many as possible
- The models are simple and easy to understand
- Some of the ideas are very new

**Weakness**

- The models reveal subjectivity to a certain extent
- Model in the primary stage
- Many factors are not considered
- Some calculating principles have not been explain clearly
- Few data can be put into testing

## *6.1 Summary*

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# Appendices

**The core codes of the BP Model:**

```
net=newff(minmax(p),[1,1],{'logsig','purelin'},'traingda');
net.trainParam.goal=0.001;
net.trainParam.show=20;
net.trainParam.epochs=1000;
net.trainParam.min_grad=1e-10;
net.trainParam.mc=0.95;
[net,tr]=train(net,p,t);
t1=sim(net,p*0.001);
t=t1*1000
```

**The core codes of Grey Prediction model,GM(1,n):**

```
PYX1=data1;
PYX2=data2;
PYX3=data3;

X0_1=PYX1./PYX1(1);
X0_2=PYX2./PYX2(1);
X0_3=PYX3./PYX3(1);

X1_1(1)=X0_1(1);
X1_2(1)=X0_2(1);
X1_3(1)=X0_3(1);
for i=2:T
   X1_1(i)=X1_1(i-1)+X0_1(i);
   X1_2(i)=X1_2(i-1)+X0_2(i);
   X1_3(i)=X1_3(i-1)+X0_3(i);
end

for i=1:T-1
   M1(i)=(0.5*(X1_1(i)+X1_1(i+1)));
   M2(i)=(0.5*(X1_2(i)+X1_2(i+1)));
   M3(i)=(0.5*(X1_3(i)+X1_3(i+1)));
end

B1=zeros(T-1,3);
for i=1:(T-1)
    B1(i,1)=-M1(i);    %-(X1_1(i)+X1_1(i+1)))/2;
    B1(i,2)=X1_2(i+1);
    B1(i,3)=X1_3(i+1);
end
```

```
B2=zeros(T-1,2);
for i=1:(T-1)
    B2(i,1)=-M2(i);    %-(X1_2(i)+X1_2(i+1)))/2;
    B2(i,2)=X1_3(i+1);
end
B3=zeros(T-1,2);
for i=1:(T-1)
    B3(i,1)=-M3(i);    %-(X1_3(i)+X1_3(i+1)))/2;
    B3(i,2)=1;
end
save B1 B1;
save B2 B2;
save B3 B3;

for i=2:T
    Y1(i-1)=X0_1(i);
    Y2(i-1)=X0_2(i);
    Y3(i-1)=X0_3(i);
end
HCS1=inv(B1'*B1)*B1'*Y1';
H1=HCS1';                              %H1=[a,b2,b3]
HCS2=inv(B2'*B2)*B2'*Y2';
H2=HCS2';                              %H2=[a,b3]  ?b2
HCS3=inv(B3'*B3)*B3'*Y3';
H3=HCS3';                              %H3=[b,a]   ?[a,b]


for i=1:T+N
YCX13(i)=(X0_3(1)-H3(2)/H3(1))*exp(-1*H3(1)*(i-1))+H3(2)/H3(1);
end
for i=2:T+N
       YCX0_3(i)=YCX13(i)-YCX13(i-1);
end
YCX0_3(1)=X0_3(1);

H2=H2./(1+0.5*H2(1));
YCX0_2(1)=X0_2(1);
for i=2:T
       YCX0_2(i)=H2(2).*X1_3(i)-H2(1).*X1_2(i-1);
end
YCX12(T)=X1_2(T);
for i=T+1:T+N
    YCX0_2(i)=H2(2).*YCX13(i)-H2(1).*YCX12(i-1);
    YCX12(i)=YCX0_2(i)+YCX12(i-1);
end



H1=H1./(1+0.5*H1(1));
YCX0_1(1)=X0_1(1);
for i=2:T
       YCX0_1(i)=H1(2).*X1_2(i)+H1(3).*X1_3(i)-H1(1).*X1_1(i-1); %b1=H1(2),b2=H1(3),a=H1(1)
end
YCX11(T)=X1_1(T);
for i=T+1:T+N
    YCX0_1(i)=H1(2).*YCX12(i)+H1(3).*YCX13(i)-H1(1).*YCX11(i-1);
    YCX11(i)=YCX0_1(i)+YCX11(i-1);
end


GM=YCX0_1.*PYX1(1)
save GM GM;
e0(1,T-1)=zeros;
```

```
for i=1:T-1
e0(i)=(X0_1(i+1)-YCX0_1(i+1))/X0_1(i+1); %1-YCX0_1(i+1)/X0_1(i+1);
end
save e0 e0;
e0_average=sum(abs(e0))/length(e0)
p=1-e0_average;


X_average=mean(X0_1)
s1=std(PYX1)
s2=std(e0.*PYX1(1))
c=s2/s1


z=2000:2011;
gm=GM(1:T);
plot(z,gm,'-',z,PYX1,'.')

YCX12(12)=57.2419;
for i=13:18
    YCX12(i)=YCX0_2(i)+YCX12(i-1);
end

YCX0_1(1)=1;
for i=2:T
       YCX0_1(i)=H1(2).*X1_2(i)+H1(3).*X1_3(i)-H1(1).*X1_1(i-1); %b1=H1(2),b2=H1(3),a=H1(1)
end
YCX11(12)=X1_1(12);
for i=13:18
    YCX0_1(i)=H1(2).*YCX12(i)+H1(3).*YCX13(i)-H1(1).*YCX11(i-1);
    YCX11(i)=YCX0_1(i)+YCX11(i-1);
end
```