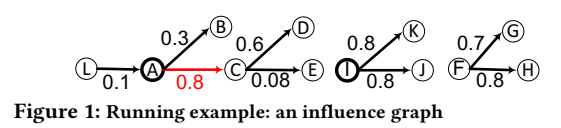


完整例子：



按照算法4的行1-5：

|  |
| --- |
| 1. 初始化 2. 设定*S* = *∅* 3. 设定*IncInf* (*v*) = 0 ，即*IncInf* (*L*) =0, *IncInf* (*A*) =0 , *IncInf* (*B*) =0 , *IncInf* (*C*) =0 , *IncInf* (*D*) =0 , *IncInf* (*E*) =0; 4. 假定*θ=0.07* 5. 计算*MIIA*(*v, θ*) 、 *MIOA*(*v, θ*)   （MIP找出概率值最大对应的路径）    （所有大于*θ的MIP*） |



*MIP*(?, *L*) =*∅*, *MIIA*(*L, θ*)= *∅* ;

*MIP*(*L, A*) ={*L,A*} (0.1>0.07), *MIIA*(*A, θ*)={*A*, *L*};

*MIP*(*L,B*) ={*L,A,B*} (0.03<0.07), *MIP*(*A,B*)={*A,B*}(0.3>0.07), *MIIA*(*B, θ*) ={*A,B*} ;

*MIP*(*L,C*) = {*L,A,C*}(0.08>0.07), *MIP*(*A,C*) = {*A,C*}(0. 8>0.07), *MIIA*(*C, θ*) ={*A,C*};

*MIP*(*L,D*) ={*L,A,C*,*D*}(0.048<0.07), *MIP*(*A,D*) ={ *A,C*, *D*}(0.48>0.07), *MIP*(*C,D*) ={*C,D*}(0.6>0.07), *MIIA*(*D, θ*) ={*A*,*C,D*};

*MIP*(*L,E*) ={ *L,A,C*, *E*}(0.0064<0.07) , *MIP*(*A,E*) ={ *A,C*, *E* }(0.064<0.07), *MIP*(*C,E*) ={*C,E*}(0.08>0.07), *MIIA*(*E, θ*) ={*C,E*};

|  |
| --- |
| *汇总MIIA*(*L, θ*)= *∅*  *MIIA*(*A, θ*)={*A*, *L*}  *MIIA*(*B, θ*) ={*A,B*}  *MIIA*(*C, θ*) ={*A,C*}  *MIIA*(*D, θ*) ={*A*,*C,D*}  *MIIA*(*E, θ*) ={*C,E*} |

求MIIA算法小结：

1. 遍历每个节点V=L，A，B, C，D，E
2. 其他任意节点到V的MIP路径
3. 选择其中大于*Θ*的存入MIIA



*MIP*(*L, A*) ={ *L,A* }(0.1> *θ=0.07*), *MIP*(*L,B*) ={*L,A*,*B*}(0.03<*θ=0.07)*, *MIP*(*L,C*) ={*L, A* ,*C*}(0.08>*θ=0.07*)*, MIP*(*L,D*) ={ *L, A*,*C,D*}(0.048<*θ=0.07*)*, MIP*(*L,E*) ={ *L, A* ,*C*,*E*}(0.0064<*θ=0.07*)*, MIOA*(*L, θ)*={ *L, A, C* } ;

*MIP*(*A,B*) ={*A,B*}(0.3>*θ=0.07*), *MIP*(*A,C*) ={*A,C*}(0.8>*θ=0.07, MIP*(*A,D*) ={*A,C,D*}(0.48>*θ=0.07*)*, MIP*(*A,E*) ={*A,C,E*}(0.064<*θ=0.07*)*,MIOA*(*A, θ)*={*A,B,C,D*};

*MIP*(*B,?*)= *∅*，*MIOA*(*B, θ)*=*∅* ;

*MIP*(C*,?*)= *∅*，*MIOA*(*C, θ)*=*∅* ;

*MIP*(*D,?*)= *∅*，*MIOA*(*D, θ)*=*∅* ;

*MIP*(*E,?*)= *∅*，*MIOA*(*E, θ)*=*∅* ;

|  |
| --- |
| *汇总MIOA*(*L, θ)*={ *L, A, C* }  *MIOA*(*A, θ)*={*A,B,C,D*};  *MIOA*(*B, θ)*=*∅*  *MIOA*(*C, θ)*=*∅*  *MIOA*(*D, θ)*=*∅*  *MIOA*(*E, θ)*=*∅* |

求MIOA算法小结：

1. 遍历每个节点V=L，A，B, C，D，E
2. V到其他任意节点的MIP路径
3. 选择其中大于*Θ*的存入MIOA

|  |
| --- |
| 1. *ap*(u, S, *MIIA*(v, θ)) = 0, ∀u ∈ *MIIA*(v, θ)   按照步骤5结果，且当前*S* = ∅需要设定 |

*MIIA*(*L, θ*) )= *∅* ;

*MIIA*(*A, θ*)={*A*, *L*}，

*ap*(L )=*ap*(L, S, *MIIA*(A, θ)) =0,

*ap*(A *)=ap*(A, S, *MIIA*(A, θ)) = 1-(1-ap(L)\*pp(L,A))=1-(1-0)=0;

*MIIA*(*B, θ*) ={*A,B*},

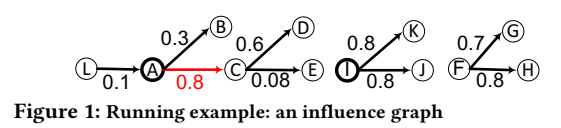
*ap*(A, S, *MIIA*(B, θ)) = 1-(1-ap(L, S, *MIIA*(B, θ))\*pp(L,A))=0,

*ap*(B, S, *MIIA*(B, θ)) = 1-(1-ap(A)\*pp(A,B))=0;

*MIIA*(*C, θ*) ={*A,C*}, *ap*(C, S, *MIIA*(C, θ)) = 0, *ap*(A, S, *MIIA*(C, θ)) = 0;

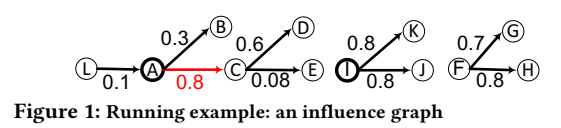
*MIIA*(*D, θ*) ={*A*,*C,D*}, *ap*(A, S, *MIIA*(D, θ)) = 0, *ap*(C, S, *MIIA*(D, θ)) = 0, *ap*(D, S, *MIIA*(D, θ)) = 0;

*MIIA*(*E, θ*) ={*C,E*}, *ap*(E, S, *MIIA*(E, θ)) = 0, *ap*(C, S, *MIIA*(E, θ)) = 0.



1 :if u ∈ S then2: ap(u) = 1  
3: else if *N*in(*u*) = ∅ (节点集合中 节点u 的入邻居)*then*4: ap(*u*) = 05: *else*6: *ap*(*u*) = 1 - Π*w*∈*N*in *(u)*(1 - ap(*w*) · pp(*w, u*))

|  |
| --- |
| *ap*(u, S, *MIIA*(v, θ)) : the activation probability of any node *u* in  MIIA(*v, θ*) 集合MIIA(v, θ)中 *u*节点被 种子集合中节点 激活的概率  若是第一次执行算法，种子集合为空， *ap*(u)=0；(这种写法是简写，需要S和MIIA)**以后会随着S集合变化继续更新**    *ap*(L, S, *MIIA*(A, θ)) =0  *ap*(A, S, *MIIA*(A, θ)) =0  ap(L, S, *MIIA*(B, θ))=0  *ap*(A, S, *MIIA*(B, θ))=0  *ap*(A, S, *MIIA*(C, θ)) = 0  *ap*(C, S, *MIIA*(C, θ)) = 0  *ap*(A, S, *MIIA*(D, θ)) = 0  *ap*(C, S, *MIIA*(D, θ)) = 0  *ap*(D, S, *MIIA*(D, θ)) = 0  *ap*(C, S, *MIIA*(E, θ)) = 0  *ap*(E, S, *MIIA*(E, θ)) = 0  第二次执行该步骤需要先按照算法2计算*ap*(u, S, *MIIA*(v, θ))  *若是第二次执行算法2, S={A}*  *MIIA*(*L, θ*) )= *∅* ;  *MIIA*(*A, θ*)={*A*, *L*}，*ap*(A, S, *MIIA*(A, θ)) = 0, *ap*(L, S, *MIIA*(A, θ)) = 0;  *MIIA*(*B, θ*) ={*A,B*}, *ap*(B, S, *MIIA*(B, θ)) = 0, *ap*(A, S, *MIIA*(B, θ)) = 0;  *MIIA*(*C, θ*) ={*A,C*}, *ap*(C, S, *MIIA*(C, θ)) = 0, *ap*(A, S, *MIIA*(C, θ)) = 0;  *MIIA*(*D, θ*) ={*A*,*C,D*}, *ap*(A, S, *MIIA*(D, θ)) = 0, *ap*(C, S, *MIIA*(D, θ)) = 0, *ap*(D, S, *MIIA*(D, θ)) = 0;  *MIIA*(*E, θ*) ={*C,E*},  算法2小结：三种情况的激活概率   1. 节点u若属于种子节点集合S，激活自己的概率是1； 2. 节点u若无入邻居节点（起点），无节点影响，故为0； 3. 节点u若不属于种子节点集合S，也不是起点，故节点u受到其他节点w的传播影响。 |
| 1. 算法3：计算*α*(*v, u*)*,* ∀*u* ∈ *MIIA*(*v, θ*)，表示任意两节点间影响程度系数。   *其中行9：*  *u*到 *v， w*到*v u*激活*w*  *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w))  *N*in(*u*, MIIA(*v, θ*)) ： be the set of in-neighbors of *u* in MIIA(*v, θ*)  MIIA(*v, θ*)节点集合中 节点u 的入邻居    算法3小结  3：节点u自身影响程度为1  6：种子节点u具有自发影响别的节点的能力，w作为种子节点，u再通过w传播被阻断， 下图示意  u->W->v  8： W作为中间节点，u对v的影响程度值*α*(*v, u*)，需要减去u’对v的影响  u->w->v  u’->w->v |



*MIIA*(*A, θ*)={*A*, *L*},

*v=A, u=A, α*(*v, u*)=*α*(*A, A*)=1;

*v=A, u=L, w=A*是*u=L*的出邻居节点*，α*(*v, u*)=*α*(*A, L)*

此刻*，A=w=v* 且不属于种子节点*S集合*

按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，

*α*(*A, L) =α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*A, A*)\* pp(L, A)=1\*0.1=0.1

*MIIA*(*B, θ*) ={*A,B*},

*v=B, u=B, α*(*v, u*)=*α*(*B, B*)=1;

*v=B, u=A, w=B*是*u=A*的出邻居节点*，α*(*v, u*)=*α*(*B, A*)

此刻*，B=w=v* 且不属于种子节点*S集合*

按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，

*α*(*B, A*) =*α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*B, B*)\* pp(A, B)=1\*0.3=0.3

*MIIA*(*C, θ*) ={*A,C*},

*v=C, u=C, α*(*v, u*)=*α*(*C, C*)=1;

*v=C, u=A, w=C*是*u=A*的出邻居节点*，α*(*v, u*)=*α*(C, *A*)

此刻*，C=w=v* 且不属于种子节点*S集合*

按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，

*α*(C, *A*) =*α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*C, C*)\* pp(A, C)=1\*0.8=0.8

*MIIA*(*D, θ*) ={*A*,*C,D*},

*v=D, u=D, α*(*v, u*)=*α*(*D, D*)=1;

*v=D, u=C, w=D*是*u=C*的出邻居节点*，α*(*v, u*)=*α*(*D, C*);

此刻*，D=w=v* 且不属于种子节点*S集合*

按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，

*α*(*D,C* )=*α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*D, D*)\* pp(C, D)=1\*0.6=0.6

|  |
| --- |
| *算不出来！*  *v=D, u=A, w=B和C* 都是*u=A*的出邻居节点*，α*(*v, u*)=*α*(*D, A*);  此刻*，存在两种情况？？？：*  *1） B=w* 且不属于种子节点*S集合*  按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，u′ =A=u，  *α*(*D, A*)=*α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*D, B*)\* pp(A, B)=？\*0.6  2）C*=w* 且不属于种子节点*S集合*  按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，u′ =A=u，  *α*(*D, A*)=*α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*D, C*)\* pp(A, C)=0.8\*0.6=0.48 |

*MIIA*(*E, θ*) ={*C,E*},

*v=E, u=E, α*(*v, u*)=*α*(*E, E*)=1;

*v=E, u=C, w=E*是*u=C*的出邻居节点*，α*(*v, u*)=*α*(E*, C*) ；

此刻*，E=w=v* 且不属于种子节点*S集合*

按照 *α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算，u′=C=u

*α*(E*, C*) =*α*(*v, u*)= α(v, w) · pp(u, w) = *α*(*D, D*)\* pp(C, E)=1\*0.08=0.08

|  |
| --- |
| 第一次计算，等价于pp(u, v), 后面会受到ap值影响发生变化  *α*(*A, L) =*0.1  *α*(*B, A*) =0.3  *α*(C*,A) =*0.8  *α*(*D,C* )= 0.6  *α*(*D, A*)=0.48  *α*(E*, C*)=0.08 |

|  |
| --- |
| 1. 计算IncInf(u*) ，*这是判定节点u是否为种子节点的判据   *IncInf (u) +=α(v, u) · (1 - ap(u, S, MIIA(v, θ)))*  **第一次已知***S 为空集，ap(u, S, MIIA(v, θ))=0* |

*MIIA*(*A, θ*)={*A*, *L*},

*v=A, u=A,* *IncInf (A) +=α(A, A) · (1 - ap(A, S, MIIA(A, θ))=1*

*（说明：其他节点w传播到v，其他节点u可能是种子，排除种子节点对u的影响，才是u=A节点“自发”产生的影响）*

*v=A, u=L,* *IncInf (L) +=α(A, L) · (1 - ap(L, S, MIIA(A, θ))=0.1* (见第7步)

*MIIA*(*B, θ*) ={*A,B*},

*v=B, u=B, IncInf (B) +=α(B, B) · (1 - ap(B, S, MIIA(B, θ))=1*

*v=B, u=A, IncInf (A) +=α(B, A) · (1 - ap(A, S, MIIA(B, θ))=1+0.3=1.3*

*MIIA*(*C, θ*) ={*A,C*},

*v=C, u=C, IncInf (C) +=α(C, C) · (1 - ap(C, S, MIIA(C, θ))=1*

*v=C, u=A, IncInf (A) +=α(C, A) · (1 - ap(A, S, MIIA(C, θ))=1.3+0.8=2.1*

*MIIA*(*D, θ*) ={*A*,*C,D*},

*v=D, u=D, IncInf (D) +=α(D, D) · (1 - ap(D, S, MIIA(D, θ))=1*

*v=D, u=C, IncInf (C) +=α(D, C) · (1 - ap(C, S, MIIA(D, θ))=0.6+1=1.6*

*v=D, u=A, IncInf (A) +=α(D, A) · (1 - ap(A, S, MIIA(D, θ))=2.1+0.48=2.58*

*MIIA*(*E, θ*) ={*C,E*},

*v=E, u=E, IncInf (E) +=α(E, E) · (1 - ap(E, S, MIIA(E, θ))=1*

*v=E, u=C, IncInf (C) +=α(E, C) · (1 - ap(C, S, MIIA(E, θ))=0.08+1.6=1.68*

*步骤8小结：*

1. *遍历节点v=A,B,C,D,E*
2. *计算IncInf (v)*

|  |
| --- |
| 累加后汇总：  *IncInf (L)=0.1*  *IncInf (A)= 2.1+0.48=2.58 （最大）*  *IncInf (B)=1*  *IncInf (C)=1.68*  *IncInf (D)=1*  *IncInf (E)=1*  **1-12 初始化完毕** |
| 14.u = arg max v∈V \S{IncInf (v)} | |

第一轮选择A节点 u =A

|  |
| --- |
| 16-21.  v ∈ MIOA(u, θ) \ S  w ∈ MIIA(v, θ) \ S  计算IncInf(w*) IncInf (w) -=α(v, w) · (1 - ap(w, S, MIIA(v, θ)))*  说明：  既然u是最有可能的种子节点，那么w对v的影响可省去，故减去。如图示意：  W->u->v |

u =A（说明：u作为发起节点且不属于种子节点集合S）

*MIOA*(*A, θ)* \ S ={*A,B,C,D*};

v=A

MIIA(A, θ) \ S={ *A*, *L* }

w=A

IncInf(A*) - = IncInf (w) -=α(A, A) · (1 - ap(A, S, MIIA(A, θ)))=1.58*

w=L

IncInf(L*) - = IncInf (w) -=α(A, L) · (1 - ap(L, S, MIIA(A, θ)))=0*

v=B

*MIIA*(*B, θ*) \ S ={*A,B*}

w=A

IncInf(A*) - = IncInf (w) -=α(B, A) · (1 - ap(A, S, MIIA(B, θ)))=1.28*

w=B

IncInf(B*) - = IncInf (w) -=α(B, B) · (1 - ap(B, S, MIIA(B, θ)))=0*

v=C

*MIIA*(*C, θ*) \ S ={*A,C*}

w=A

IncInf(A*) - = IncInf (w) -=α(C, A) · (1 - ap(A, S, MIIA(C, θ)))=1.28-0.8=0.48*

w=C

IncInf(C*) - = IncInf (w) -=α(C, C) · (1 - ap(C, S, MIIA(C, θ)))=0.68*

v=D

*MIIA*(*D, θ*) \ S ={*A,C,D*}

w=A

IncInf(A*) - = IncInf (w) -=α(D, A) · (1 - ap(A, S, MIIA(D, θ)))=0.48-0.48=0*

w=C

IncInf(C*) - = IncInf (w) -=α(D, C) · (1 - ap(C, S, MIIA(D, θ)))=0.08*

w=D

IncInf(D*) - = IncInf (w) -=α(D, D) · (1 - ap(D, S, MIIA(D, θ)))=0*

|  |
| --- |
| *汇总* IncInf(D)：  *IncInf (L)=0*  *IncInf (A)= 0 （最大）*  *IncInf (B)=0*  *IncInf (C)=0.08*  *IncInf (D)=0*  *IncInf (E)=1* |

|  |
| --- |
| 22． *S* = *S ∪ {u} 节点u并入S集合* |

*S =A*

|  |
| --- |
| 23-30．S集合变化了，ap, *α*需要同时更新  v ∈ MIOA(u, θ) \ S  计算*ap(w, S, MIIA(v, θ)) ，*w ∈ MIIA(v, θ)  计算*α(v, w )，* w ∈ MIIA(v, θ)  w ∈ MIIA(v, θ) \ S （排除种子集合中的）  计算IncInf(w*) IncInf (w) +=α(v, w) · (1 - ap(w, S, MIIA(v, θ)))* |

u =A

v ∈ *MIOA*(*A, θ)* \ S ={*B,C,D*};

|  |
| --- |
| *算法2：计算 ap(w, S, MIIA(v, θ)),* w∈ *MIIA*(*B, θ*)  *算法3：*计算*α(v, w )，* w ∈ MIIA(v, θ) |

v=B 对应

w∈ *MIIA*(*B, θ*) ={*A,B*}

w=A,B

*ap(A, S, MIIA(B, θ))=1* (A ∈ S) ,

*α(v, w )=α(B, A )= α(B, B )\*pp(A,B) =1\*0.3=0.3*

*ap(B, S, MIIA(B, θ))=1-(1-ap(A)\*PP(A,B))=0.3*

*α(v, w )=α(B, B )= 1*

IncInf(w*) IncInf (B) +=α(B, B) · (1 - ap(B, S, MIIA(B, θ)))=0.7*

v=C

w∈ *MIIA*(*C, θ*) ={*A,C*}

w=A,C

*ap(A, S, MIIA(C, θ))=1 ,* (A ∈ S) ,

*α(v, w )=α(C, A )= α(C, B )\*pp(A, B )=?\*0.3*

*IncInf(A)*不用计算,故算不出来不影响

*ap(C, S, MIIA(C, θ))=1-(1-ap(A)\*PP(A,B))=0.3*

*α(v, w )=α(C, C )= 1*

*IncInf(C)+= α(C, C) · (1 - ap(C, S, MIIA(C, θ)))=0.7*

*IncInf(C)+=0.08+0.7=0.78*

v=D

w∈ *MIIA*(*D, θ*) ={*A,C,D*}

w=A,C,D

*ap(A, S, MIIA(D, θ))=1 ,* A∈S

*α(v, w )=α(D, A )= α(D, B )\*pp(A,B)=?\*0.3*

*IncInf(A)*不用计算，故算不出来不影响

*ap(C, S, MIIA(D, θ))=1-(1-ap(A)\*pp(A,B))=0.3*

*α(v, w )=α(D, C )= α(D, D )\*pp(C,D)=1\*0.6=0.6*

*另，中间过程：w=D*是*u=C*的出邻居节点，*α*(*v, u*)= α(v, w) · pp(u, w) · Π u′∈Nin (w)\{u}(1 -ap(u′) · pp(u′, w)) 蓝色部分此处省去不计算

*IncInf (C) +=α(v, w) · (1 - ap(w, S, MIIA(v, θ)))=0.6\*(1-0.3)*

*IncInf (C)=0.78+0.42=1.2*

*ap(D, S, MIIA(D, θ))=1-(1-ap(A)\*pp(A,B))=0.3*

*α(v, w )=α(D, D)= 1*

*IncInf (D) +=α(v, w) · (1 - ap(w, S, MIIA(v, θ)))=1\*(1-0.3)=0.7*

*IncInf (D)=0.7*

|  |
| --- |
| *汇总*  *IncInf (L)=0*  *IncInf (A)= 2.58 （已选）*  *IncInf (B)=0.7*  *IncInf (C)=1.2 （第二次选择）*  *IncInf (D)=0.7*  *IncInf (E)=1* |

*第二次尝试选节点C,回到P13按照代码14行重新计算*

u =C

v ∈ *MIOA*(*C, θ)* \ S =*∅* ;

？？？？