输入：铅罐及放射源个数 N

输出：**K, H**

1. do
2. do
3. $S_i \leftarrow \text{locate}(P_0)$
4. $\phi(S_n) \leftarrow \sum_{i=1}^{n-1} \left(\| S_n - S_i \| < \lambda \right)$
5. if $\phi(S_n)$==0
6. break
7. 机器人实际抓取
8. $S \leftarrow S \cup S_n$
9. n $\leftarrow n + 1$
10. 存储**K**(S_i)及**H**
11. while(n > N)

图 S1 小概率抓取学习算法伪代码

Fig. S1 Pseudocode of the learning algorithm of small probability grasping

```
function    [K,H]=XIAOGAILV(world,ds)

xl=length(world.XO);
  d=zeros(2,xl);
K=zeros(1,xl);
H=zeros(1,2);
H(11,:)=[0 0];
k=1;
n=0;
s=0;
while(1)
m=0;
        while (1)
              c=caiyang();
              p=0;
              for kk=1:k
                    p=p+(norm(c-H(kk,:))<ds);
              end

              if p==0
                  break;
              end
```

```
            m=m+1;
             if m>=100
                  s=300;
                  break;
             end
    end
          k=k+1;
          H(k,:)=c;
    for j=1:xl
          l=norm(c-[world.XO(j) world.YO(j)]);
          if   l<=0.4
                d(:,j)=c';
                K(k,j)=1;
          else
               if (l>0.4&&l<2.5)
                  K(k,j)=-1;
               else
                  K(k,j)=0;
               end
          end
    end
  n=n+1;
 if sum(max(abs(K)))>=xl
          break;
 end
 if s==300
       n=10000;
          break;

 end

end
end
```

图 S2 小概率抓取学习算法 Matlab 程序代码

Fig. S2 Matlab code of the learning algorithm of small probability grasping

输入：K、H、N

输出：机器人抓取位姿*P*

```
do
  while(1)
    if(h ∈ ∅)
      [x y] ← locate(H(j,:))
    else
      while(1)
        [x y] ← center(H(b1(1),:),h)
        if (φ(h_s,[x y])==0)
          break
      机器人实际抓取位置[x y]
      if (R==1)
          n=n+1
      else
        if (R==-1)
          h ← h ∪ [x y]
        else
          h_s ← h_s ∪ [x y]
while(n == N)
```

图 S3 大概率抓取算法伪代码

Fig. S3 Pseudocode of the learning algorithm of large probability grasping

```
function    [d,n]=DAGAILV(world,K,H)
%%d   表示采样确定的放射源位置点
xl=length(world.XO);
d=zeros(2,xl);
n=0;
j=1;
   b=find(K(:,j)==-1);
      if ~isempty(b)
            h=[];
            n=0;
               while(1)
                    aplha=2*pi*rand(1);
                     r=2.5*rand(1);
                     x=H(b(1),1)+r*cos(aplha);
                     y=H(b(1),2)+r*sin(aplha);
                         n(j)=n(j)+1;
                         h(n(j),:)=[x y];
```

```
                if    norm([x y]-[world.XO(j) world.YO(j)])<0.4
                    d(:,j)=[x y]';
                     break;
                end
            end
end
 end
```

图 S4 大概率抓取学习算法伪代码

Fig. S4 Matlab code of the learning algorithm of big probability grasping