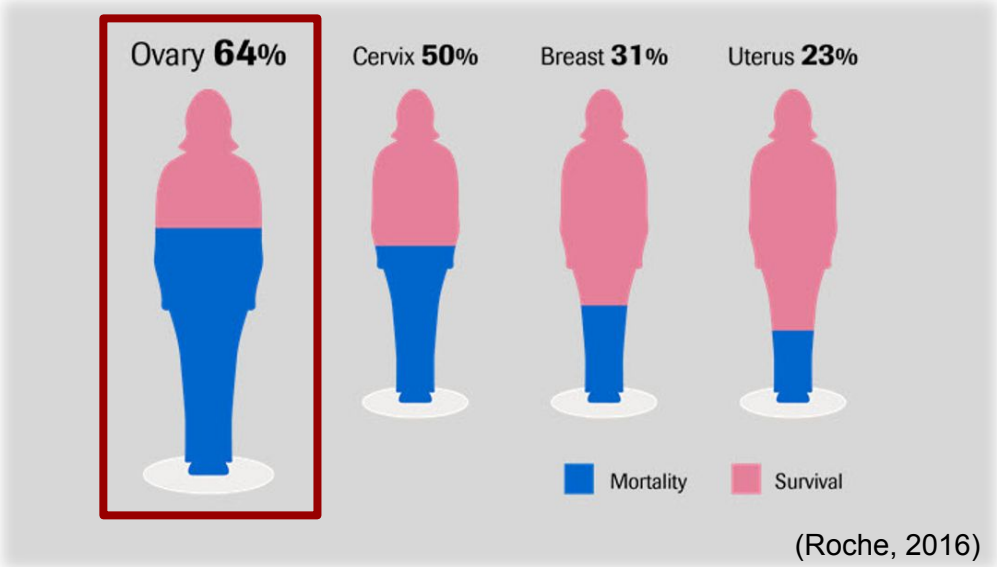
Platin-drug resistance prediction

Y.-B.Hong

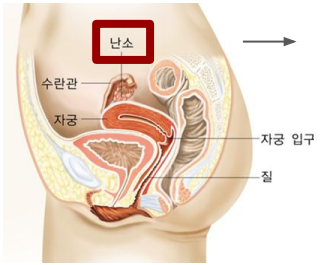
Ovarian Cancer

여성암 중 1위
난소암



(Roche, 2016)

1. 난소의 위치적 특성에 따른 늦은 발견



초기에 발병이 되더라도
증상이 없는 경우가 많음

난소암 환자 중 70~80%
: **3기 이후에 첫 진단**

2. 높은 재발률

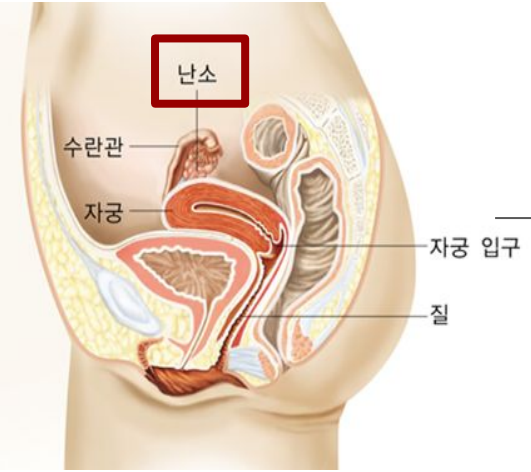
난소암 재발율은 **50-70%**

2년 이내 재발하는 경우가 많다

(대한부인종양학회, 2016)

Danger of Ovarian Cancer

1. 난소의 위치적 특성에 따른 늦은 발견



→ 초기에 발병이 되더라도 증상이 없는 경우가 많다 →

난소암 환자 중 70~80%
: **3기 이후에 첫 진단**

2. 높은 재발률

난소암 재발율은 **50-70%**, 2년 이내 재발하는 경우가 많다. (대한부인종양학회, 2016)

Danger of Ovarian Cancer

위치적 특성

복강

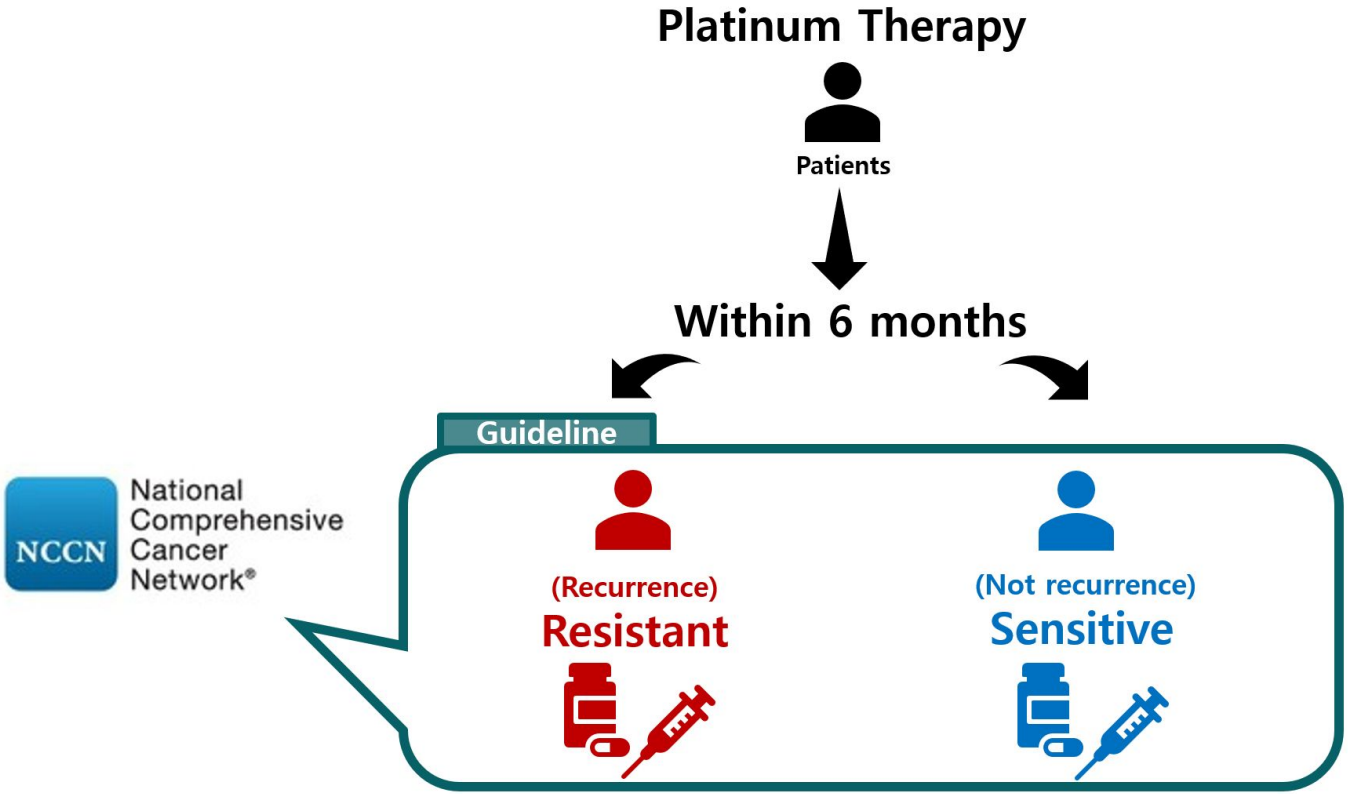
증상을 느끼기
어렵다

높은 재발률

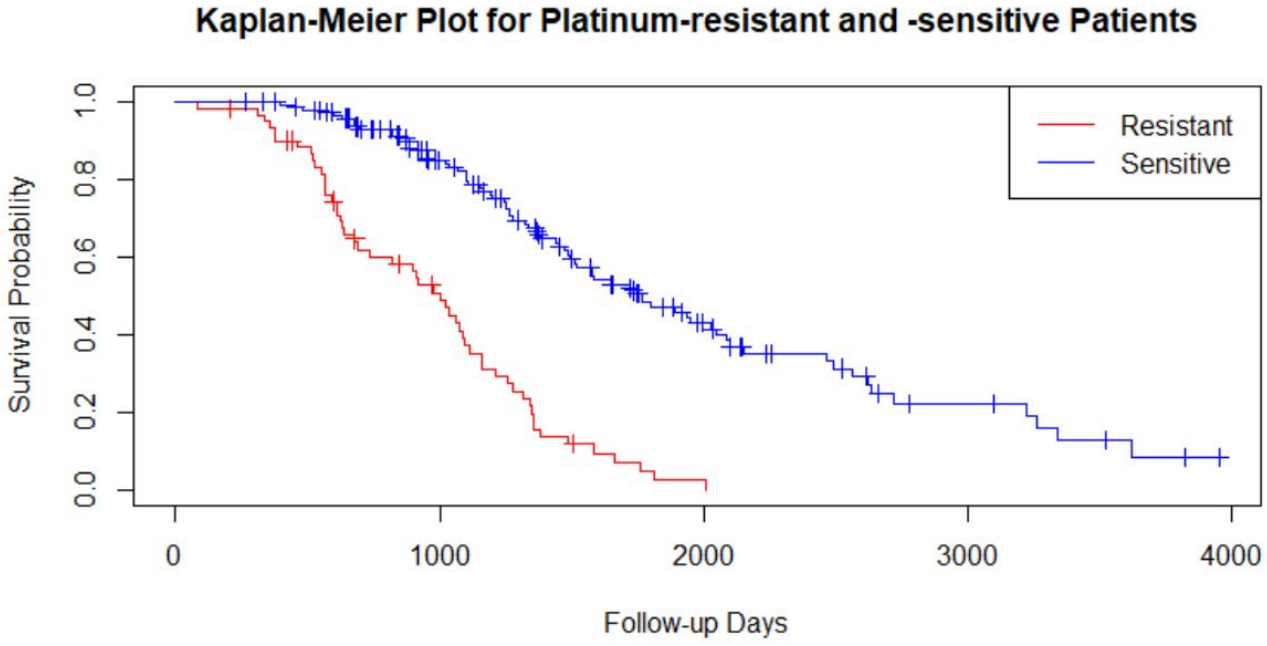
50~70%

발견되고 나서
약물치료를 거듭할
시간이 없다.

Chemotherapy for Ovarian Cancer

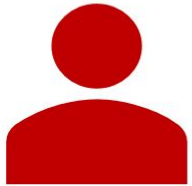


Chemotherapy for Ovarian Cancer



Resistant	Sensitive	Total
97	232	329

The Goal of our model

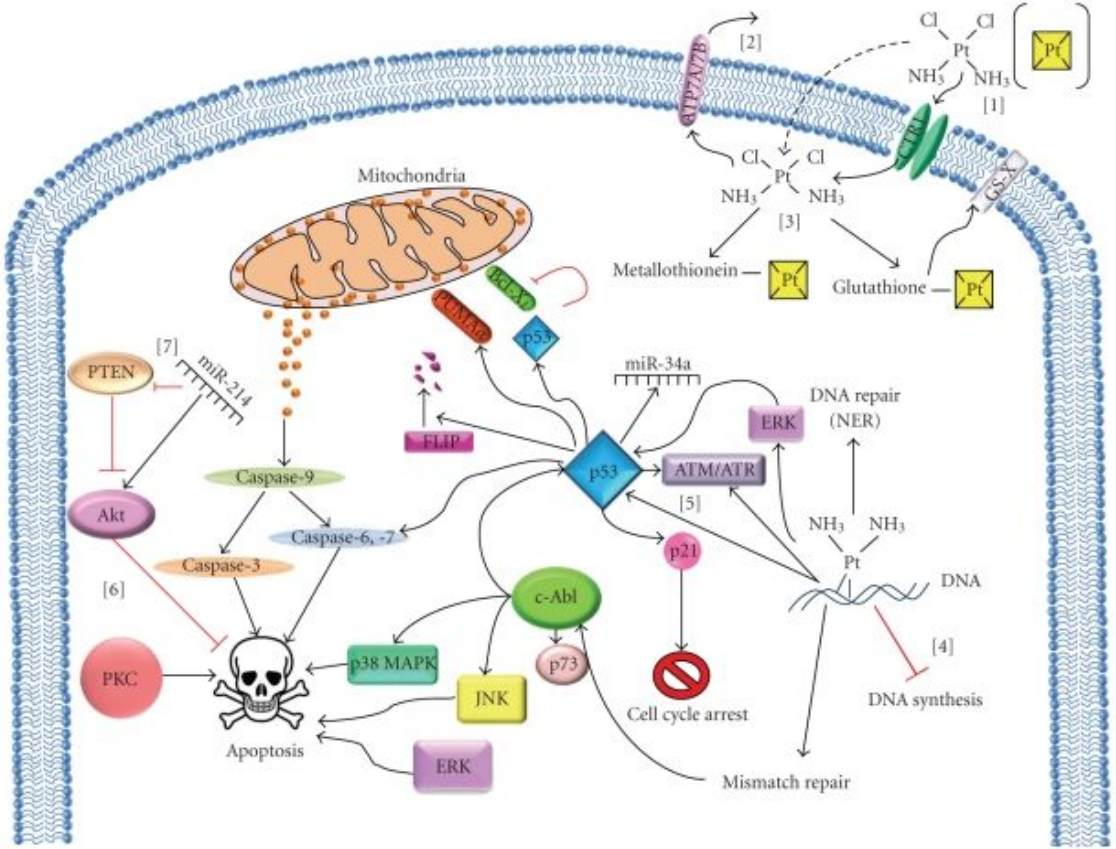


(Recurrence)
Resistant

~~Platinum Therapy~~

Other Therapy

Cause of Platinum Resistance



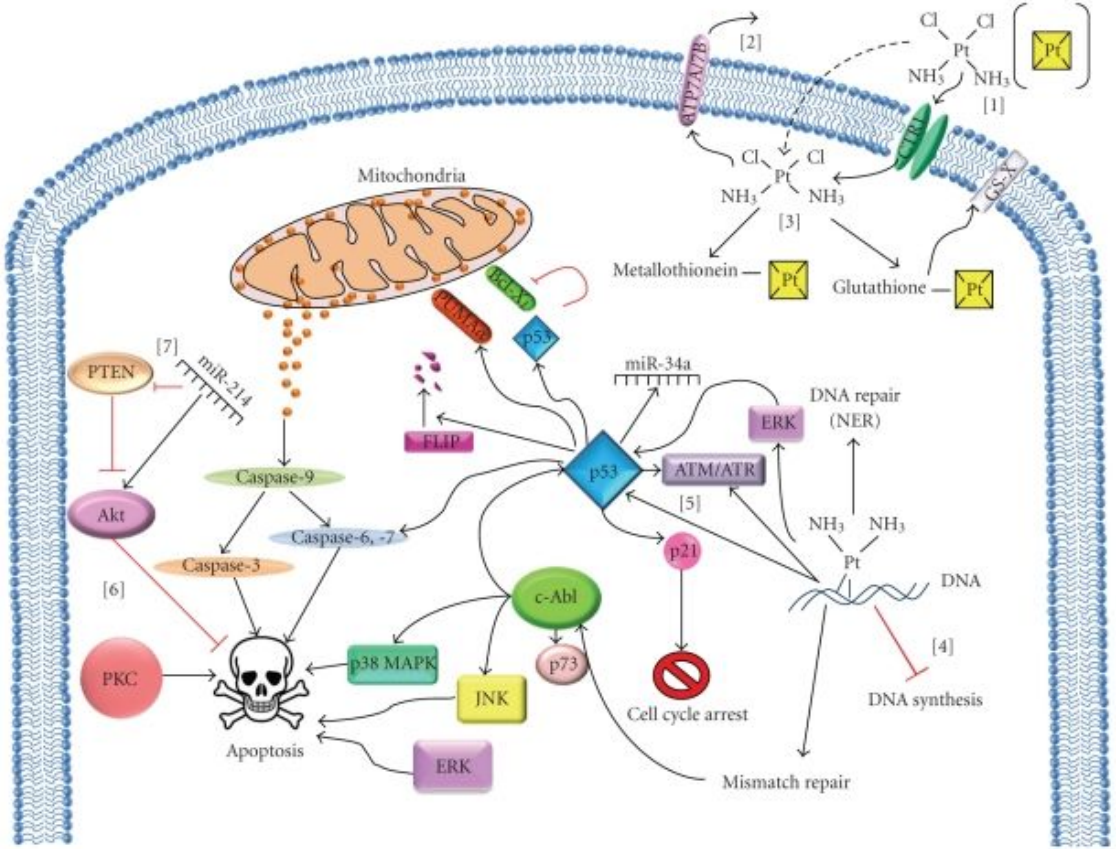
Pharmacokinetics/metabolic pathway of platinum compound (Basu, 2010).

Target therapy for cancer cells:

- DNA damage
- Cell cycle halt
- ER stress
- Decrease in ATPase activity

→ Apoptosis

Cause of Platinum Resistance



Pharmacokinetics/metabolic pathway of platinum compound (Basu, 2010).

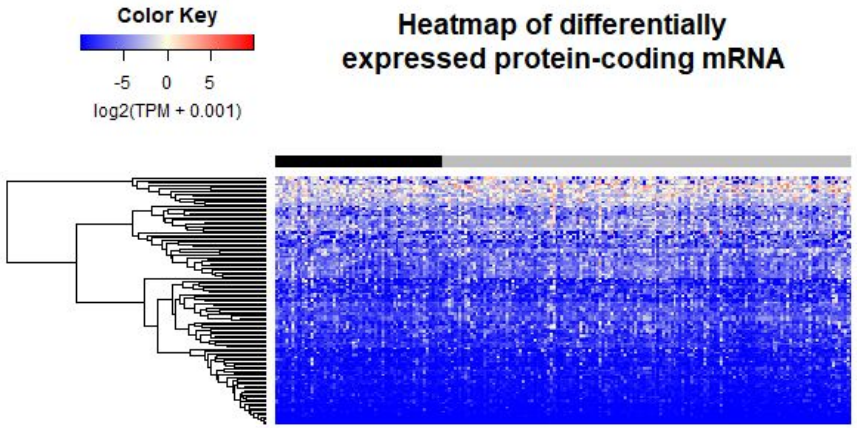
Proteins related to platinum resistance:

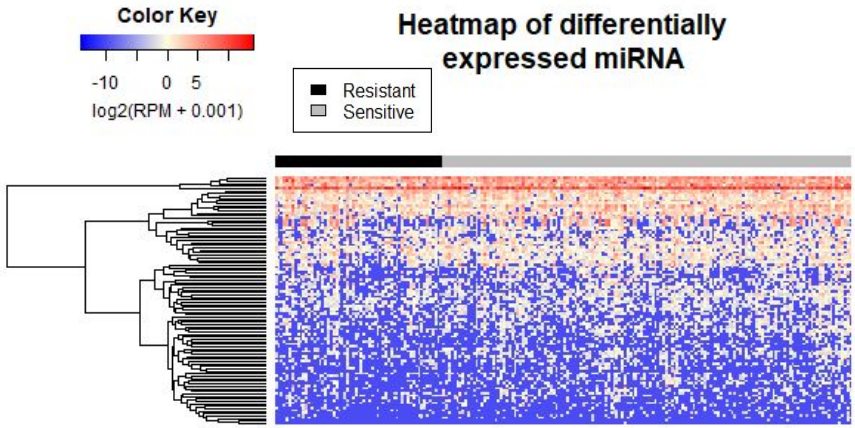
- Transporter
- Efflux of anticancer drugs
- DNA repair pathway
- Presence of miRNA and lncRNA

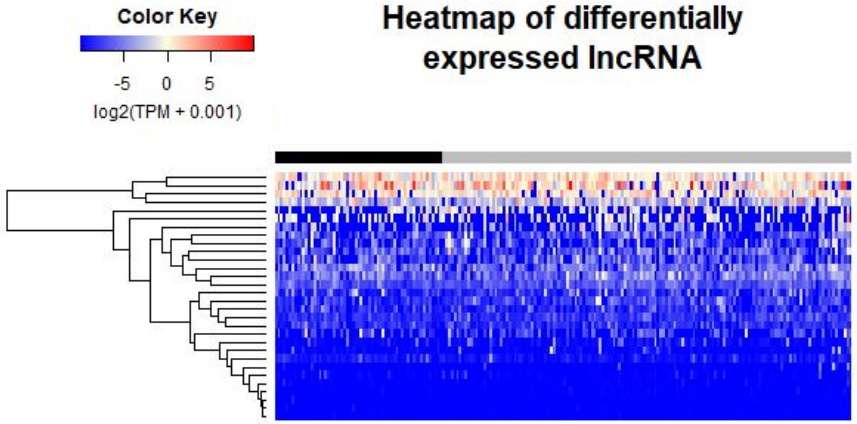
…

Limitation in predicting *in vitro*.

Cause of Platinum Resistance



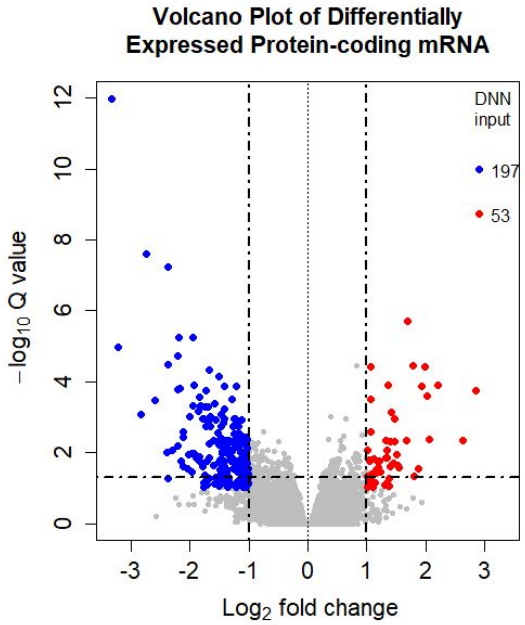


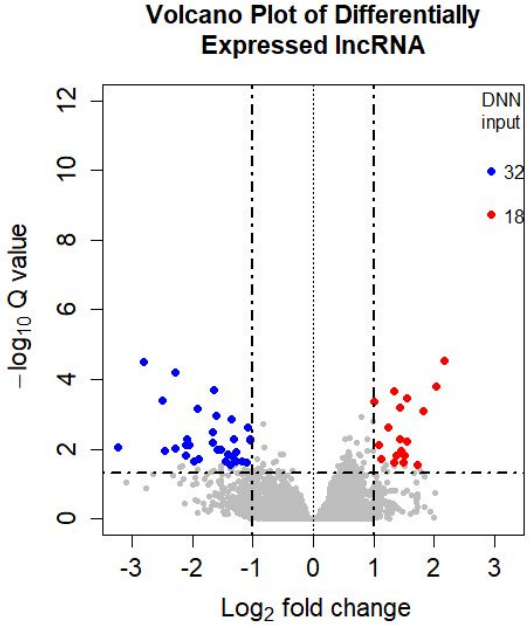


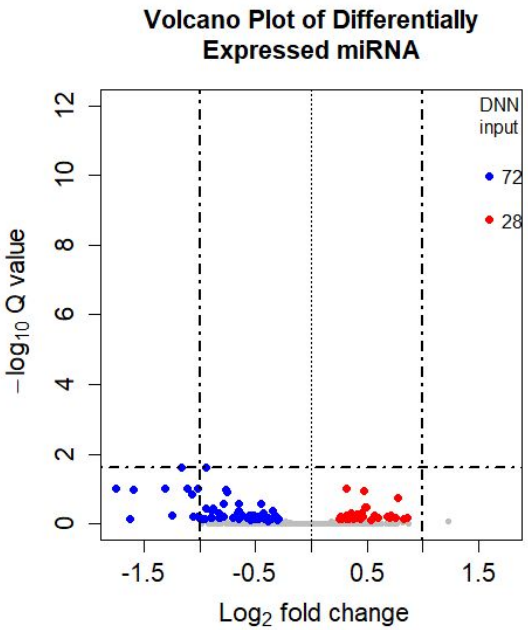
"Differentially expressed":
A gene which has lgFC > |1| and FDR <= 0.05 in a differentially expression analysis.

Resistant	Sensitive	Total
55	42	210

Input for Deep Neural Network







Patient clinical data:

Resistant	Sensitive	Total
55	42	210

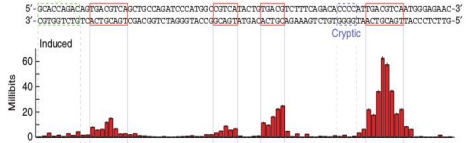
Number of input for DNN:

dePC	deLNC	deMI
250	50	100

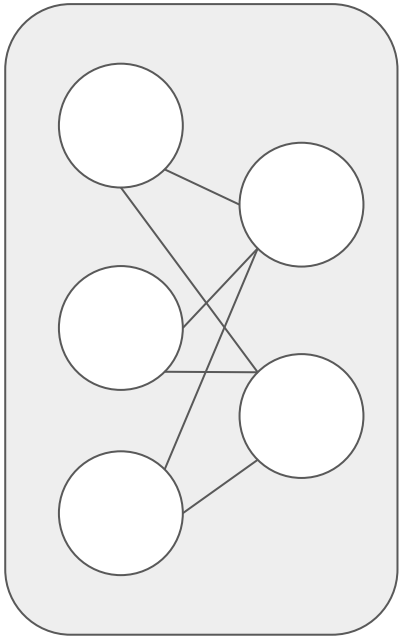
Predicting Platinum Status

Backpropagation-based

Gene expression data



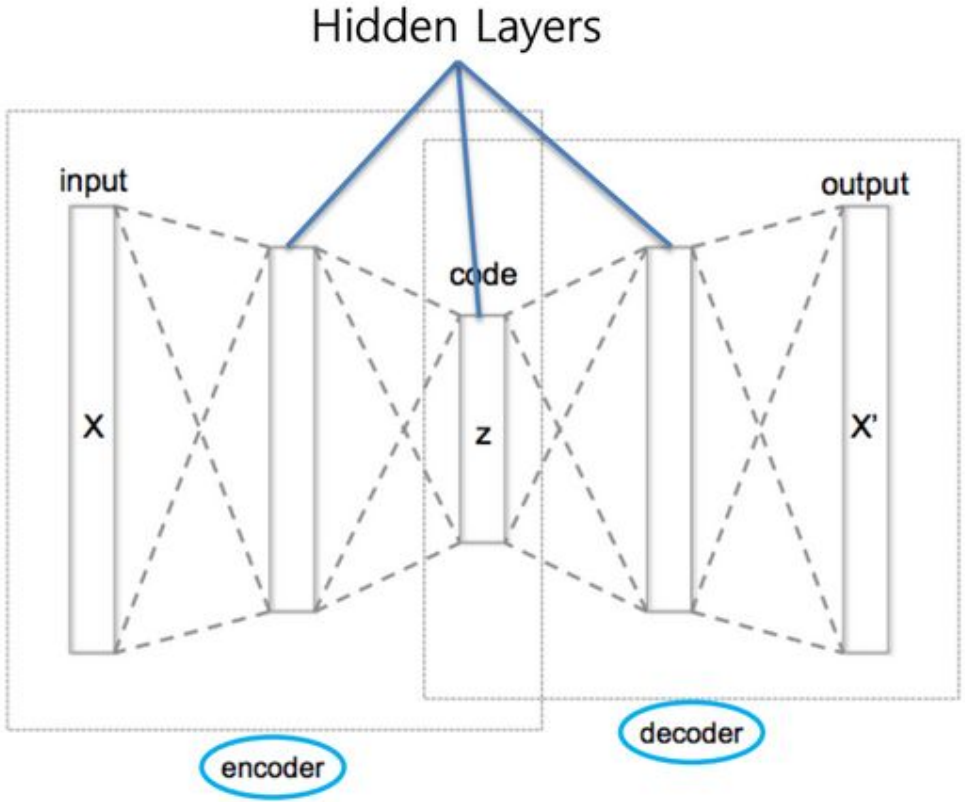
Platinum Status (0, 1)



Predict

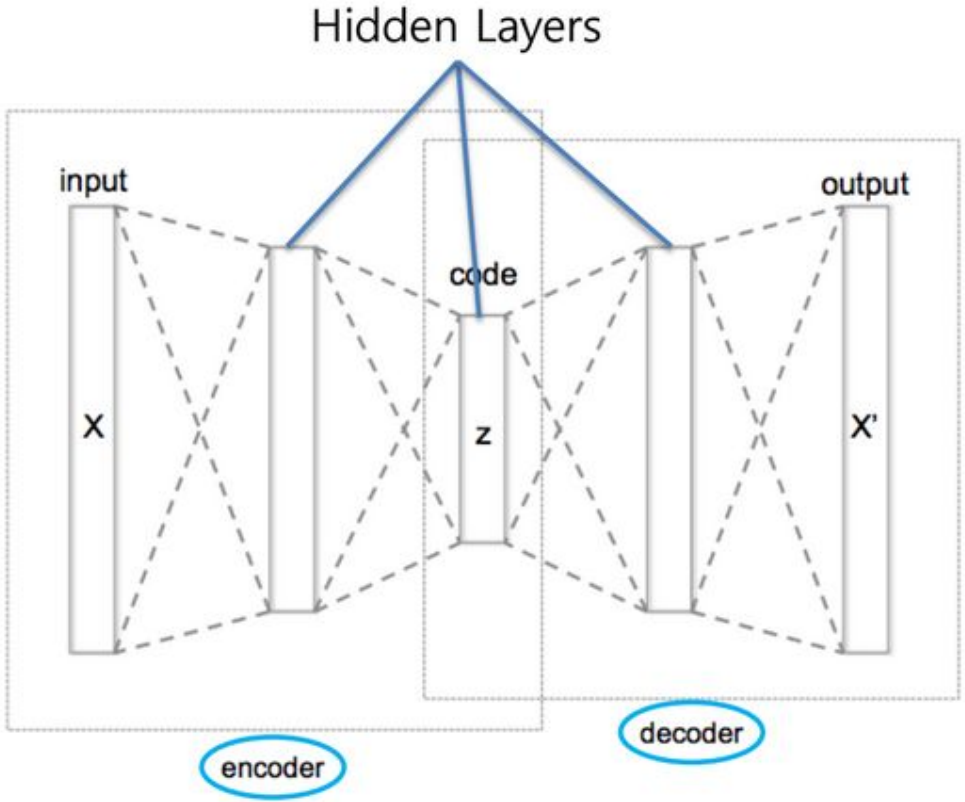
Backpropagate

Design Model

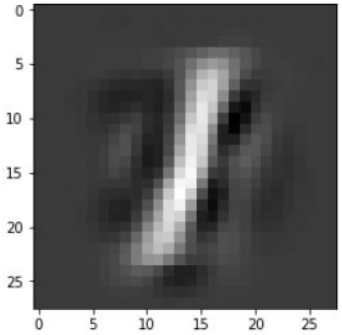



```python
class Autoencoder(nn.Module):
    def __init__(self):
        super(Autoencoder,self).__init__()
        self.encoder = nn.Linear(28*28,50)
        self.decoder = nn.Linear(50,28*28)

    def forward(self,x):
        x = x.view(batch_size,-1)
        encoded = self.encoder(x)
        out = self.decoder(encoded).view(batch_size,1,28,28)

        return out

model = Autoencoder().cuda()
```

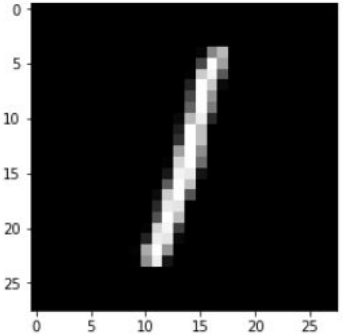
Design Model - DNN based on Autoencoder



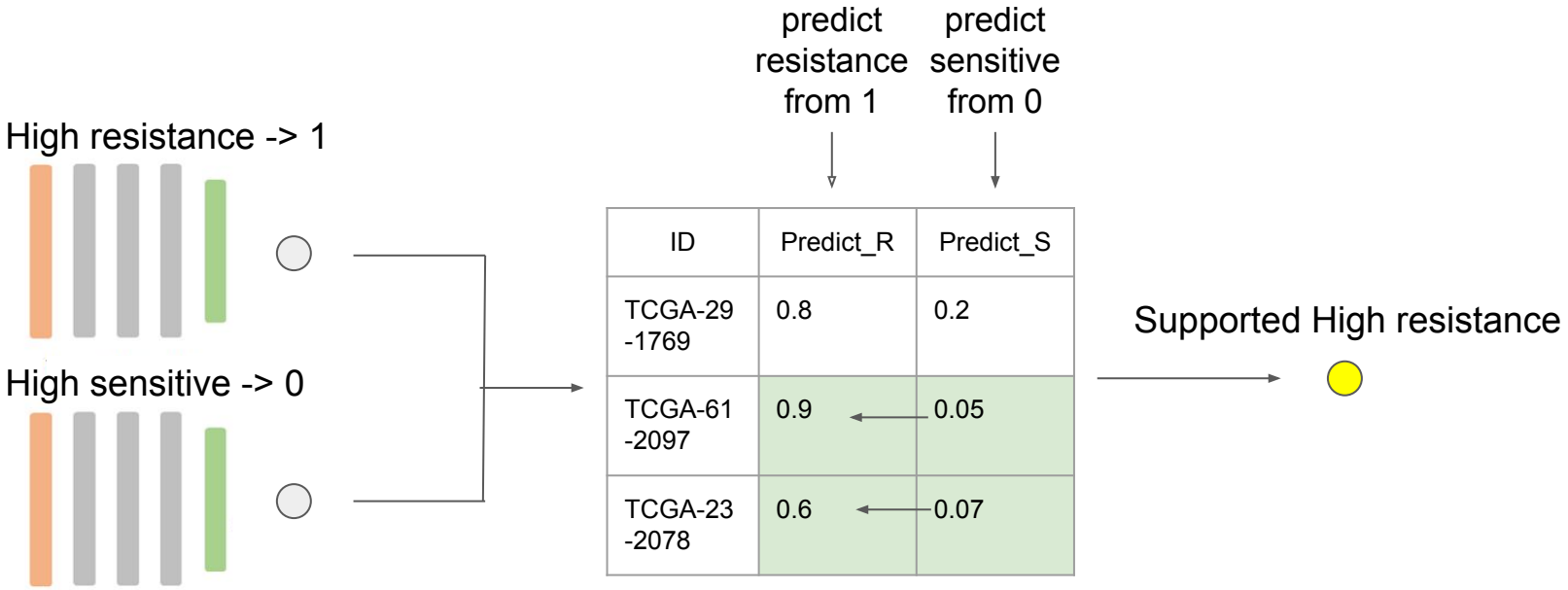
Output Data



Actual Data



Ensemble - Better voting



Ensemble - Model performance

Accuracy : 0.880952380952380 9

Sensitivity : 0.923076923076923 1

Specificity : 0.862068965517241 3

AUC: 0.892572944297082 2

[[12 1]

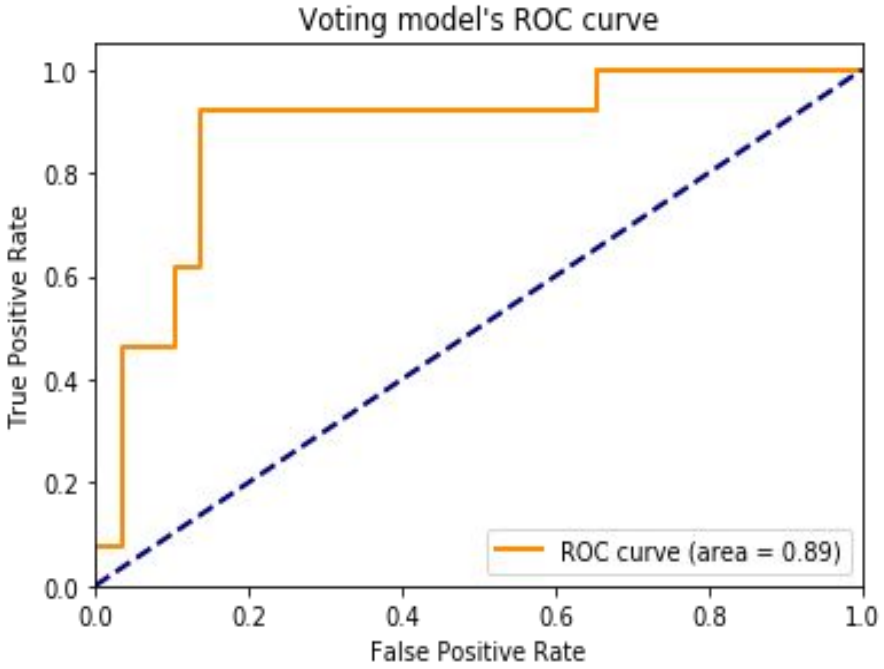
[4 25]]

Actual Cases

predicted Cases

	Resistant	Sensitive
Resistant	12	1
Sensitive	4	25

Ensemble - Model performance and more



Next model?

Competitor

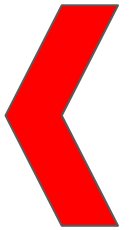
Test(Competitor based on SVM):

Accuracy: 80.0%

sensitivity: 86.7%

specificity: 68.6%

(AUC = 0.776)



Test(Our Model based on DNN):

Accuracy : 88.09523809523809 %

Sensitivity : 92.30769230769231 %

Specificity : 86.20689655172413 %

(AUC = 0.893)

Thank You