BGSSN Supplementary material

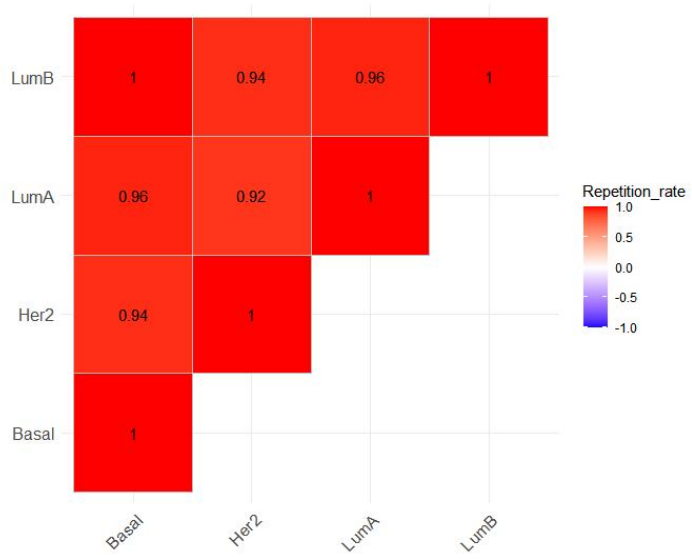
Supplementary Table1. Known associated genes of breast cancer

Gene name				
ACTB	CD24	CYP19A1	HRAS	PIK3CA
AKT1	CD274	EGF	IGF1R	PTEN
ANXA5	CD4	EGFR	IL6	SNAI1
AR	CD44	ERBB2	KRAS	SNAI2
ATM	CD8A	ERBB3	MAPK3	SRC
BCL2	CDH1	ESR1	MMP9	STAT3
BRCA1	CDH2	ESR2	MUC1	TNF
BRCA2	CDK4	FN1	MYC	TP53
CASP3	CHEK2	GAPDH	NOTCH1	VEGFA
CCND1	CTNNB1	HIF1A	PGR	ZEB1

Supplementary Table2. New breast cancer-associated genes of different subtypes

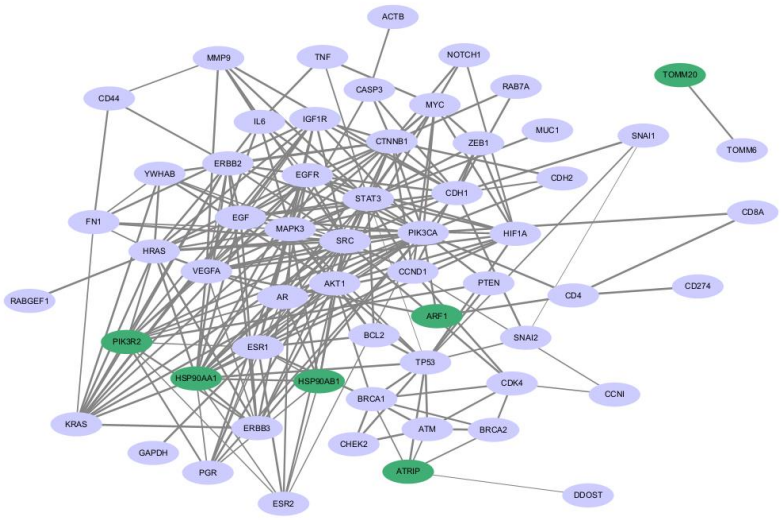
Basal	Her2	LumA	LumB
RAB7A	RAB7A	RAB7A	RAB7A
RGPD3	RGPD3	RGPD3	RGPD3
ANKHD1	ANKHD1	ANKHD1	ANKHD1
RABGEF1	RABGEF1	GHITM	RABGEF1
GHITM	GHITM	RABGEF1	GHITM
BBS1	BBS1	BBS1	BBS1
ZNF23	ZNF23	ZNF23	ZNF23
ACAD11	ACAD11	HNRNPF	ACAD11
HNRNPF	HNRNPF	ACAD11	HNRNPF
TOMM6	TOMM6	TOMM6	TOMM6
RGPD1	RGPD1	RGPD1	RGPD1
ZNF709	CYB5D1	CYB5D1	ZNF709
EEF1G	ZNF709	ZNF709	EEF1G
CYB5D1	ATRIP	YWHAB	CYB5D1
DDOST	EEF1G	EEF1G	DDOST
ATRIP	YWHAB	ATRIP	ATRIP
YWHAB	DDOST	CANX	YWHAB
RAG1	RAG1	RAG1	RAG1
CANX	RAB43	SNX15	CANX
PIK3R2	CANX	RAB43	PIK3R2
RAB43	PIK3R2	PIK3R2	RAB43
ASB3	RPSA	MSMP	ASB3
RPSA	MSMP	DDOST	RPSA
SNX15	SNX15	RPSA	SNX15
MSMP	ASB3	ASB3	MSMP
ARF1	SYN2	ARF1	ARF1
ZNF410	ZNF410	HSP90AB1	ZNF410

ZNF208	ZNF490	ZNF208	ZNF208
SYN2	ARF1	ZNF410	SYN2
ZNF490	ZNF208	HSP90AA1	ZNF490
GTF2IRD2	C1orf43	C1orf43	GTF2IRD2
TOMM20	HSP90AB1	GTF2IRD2	TOMM20
HSP90AB1	GTF2IRD2	SYN2	HSP90AB1
C17orf49	TOMM20	ZNF490	C17orf49
SCHIP1	HSP90AA1	TOMM20	SCHIP1
EIF3CL	C17orf49	EIF5AL1	EIF3CL
C7orf25	SCHIP1	C7orf25	C7orf25
EIF5AL1	C7orf25	SCHIP1	EIF5AL1
C1orf43	EIF5AL1	EIF3CL	C1orf43
HSP90AA1	EIF3CL	C17orf49	HSP90AA1
NPHP3	NPHP3	NPHP3	NPHP3
RGPD5	JTB	RGPD5	RGPD5
JTB	SARM1	JTB	JTB
U2AF1	U2AF1	ATF4	U2AF1
EIF3I	TNXB	EIF3I	EIF3I
SARM1	RGPD5	YWHAH	SARM1
GPS2	EIF3I	APEX1	GPS2
ATF4	GTF2H2C	EIF5A	ATF4
DDX47	GPS2	SARM1	DDX47
EIF5A	BTF3	U2AF1	EIF5A



Supplementary Figure S1. BGSSN predicts the duplication rate of genes associated with different subtypes of breast cancer.

(a)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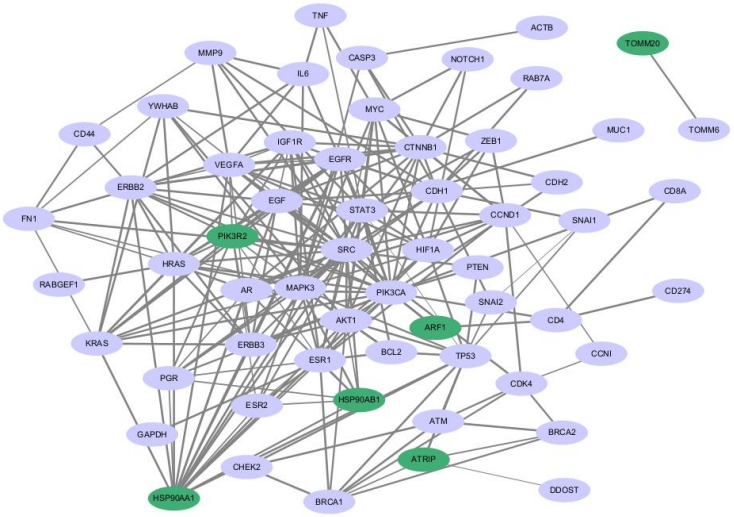
TNF
NOTCH1
TOMM20
CD44
CASP3
RAB7A
MYC
IL6
IGF1R
MUC1
SNAI1
TOMM6
CTNNB1
ZEB1
ERBB2
YWHAB
EGFR
CDH2
STAT3
CDH1
CD8A
FN1
EGF
MAPK3
PIK3CA
HIF1A
SRC
HRAS
VEGFA
CCND1
PTEN
CD274
AKT1
CD4
RABGEF1
AR
ARF1
PIK3R2
BCL2
SNAI2
ESR1
TP53
HSP90AA1
HSP90AB1
CDK4
CCNI
BRCA1
KRAS
ERBB3
ATM
BRCA2
GAPDH
CHEK2
PGR
ATRIP
DDOST
ESR2

(b)


TNF
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CASP3
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IL6
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MYC
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ZEB1
CTNNB1
VEGFA
EGFR
ERBB2
CDH1
CDH2
CD8A
EGF
CCND1
SNAI1
FN1
STAT3
PIK3R2
SRC
HIF1A
HRAS
PTEN
RABGEF1
AR
MAPK3
PIK3CA
CD274
SNAI2
AKT1
CD4
ARF1
KRAS
ERBB3
BCL2
TP53
CCNI
ESR1
PGR
CDK4
ESR2
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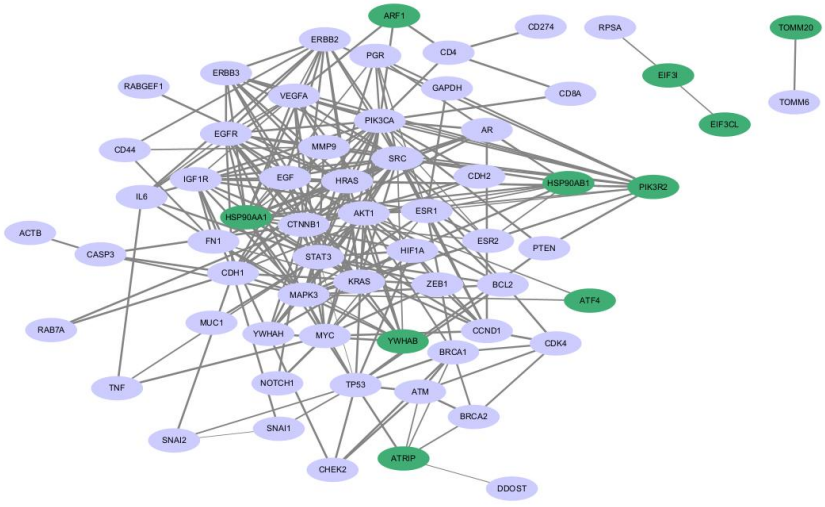
GAPDH
BRCA2
ATRIP
CHEK2
DDOST
HSP90AA1
BRCA1

(c)


ARF1
CD274
RPSA
TOMM20
ERBB2
PGR
CD4
EIF3I
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GAPDH
RABGEF1
CD8A
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TOMM6
PIK3CA
AR
EGFR
EIF3CL
MMP9
CD44
SRC
CDH2
IGF1R
EGF
HRAS
HSP90AB1
PIK3R2
IL6
AKT1
ESR1
HSP90AA1
CTNNB1
ACTB
FN1
ESR2
PTEN
CASP3
STAT3
HIF1A
CDH1
KRAS
ZEB1
BCL2
ATF4
MAPK3
MUC1
CCND1
RAB7A
YWHAH
MYC
YWHAB
CDK4
BRCA1
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NOTCH1
TP53
ATM
BRCA2
SNAI1
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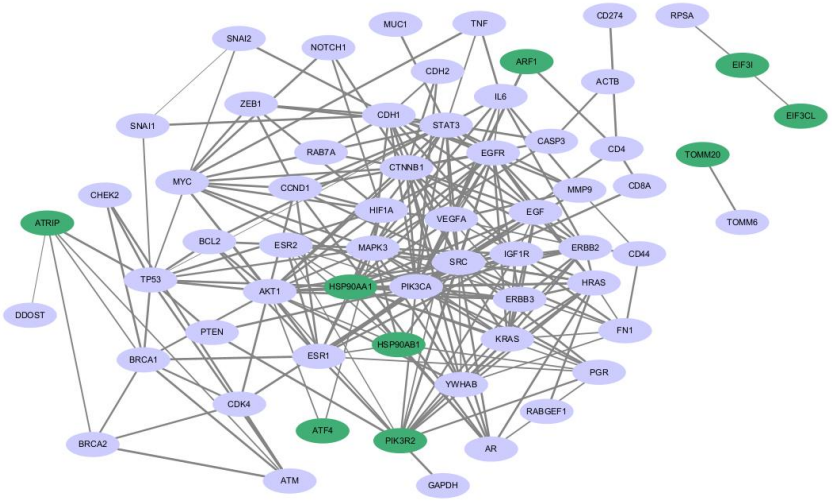
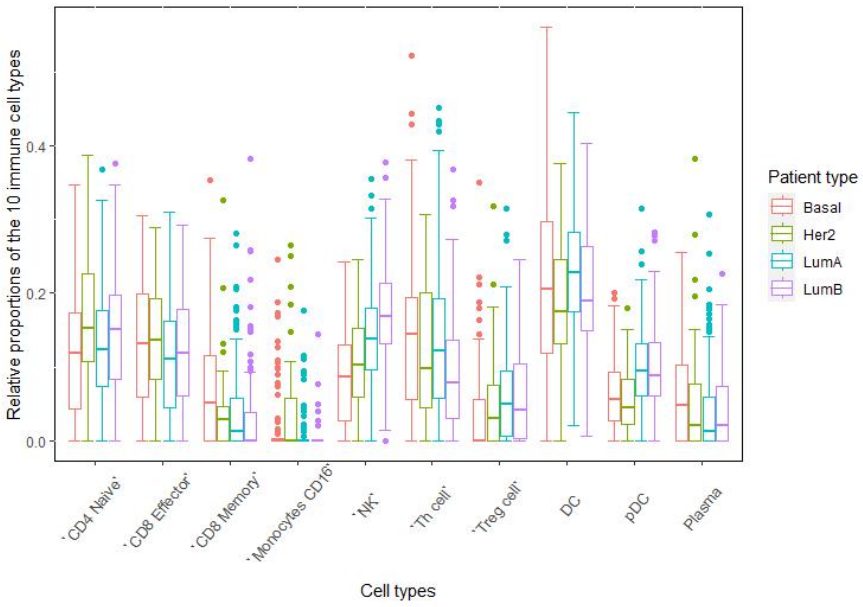
(d)



Supplementary Figure S2. (a) Associated genes interaction for predicting breast cancer subtype Basal. (b) Associated genes interaction for predicting breast cancer subtype Her2. (c) Associated genes interaction for predicting breast cancer subtype LumA. (d) Associated genes interaction for predicting breast cancer subtype LumB. Purple is known to be associated with breast cancer, and green is associated with BGSSN prediction. The stronger the correlation between genes, the thicker the edge between them.



Supplementary Figure S3. The proportion of ten immune cells in different of breast cancer subtypes.