In God we trust; all others bring data.

W. Edwards Deming

ARTIFICIAL INTELLIGENCE LAB

- **Introduction to Artificial Intelligence**

- **Programming for AI**

- **Machine Learning Basics**

- **Neural Networks and Deep Learning**

- **Natural Language Processing (NLP)**

- Overview of AI and its applications

- History and evolution of AI

- Ethical considerations in AI

Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think, learn, and make decisions. These systems can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI encompasses a wide range of technologies, including machine learning, neural networks, natural language processing, robotics, and more.

1. **Machine Learning (ML)**: A subset of AI that involves training algorithms to learn from and make predictions or decisions based on data. Common techniques include supervised learning, unsupervised learning, and reinforcement learning.

2. **Neural Networks**: Computational models inspired by the human brain, used for tasks like image and speech recognition. Deep learning, a subset of neural networks, involves multiple layers of neurons to model complex patterns.

3. **Natural Language Processing (NLP)**: Enables machines to understand, interpret, and generate human language. Applications include chatbots, language translation, and sentiment analysis.

4. **Computer Vision**: Enables machines to interpret and make decisions based on visual data from the world. Applications include facial recognition, object detection, and autonomous vehicles.

5. **Robotics**: Combines AI with mechanical engineering to create robots that can perform tasks autonomously or semi-autonomously.

Applications of AI

1. **Healthcare**

    1. **Diagnosis and Treatment**: AI algorithms can analyze medical images, predict disease outbreaks, and recommend personalized treatment plans.

    2. **Drug Discovery**: AI accelerates the process of drug discovery by predicting how different compounds will interact with targets in the body.

2. **Finance**

    1. **Algorithmic Trading**: AI systems can analyze market data and execute trades at high speeds.

    2. **Fraud Detection**: Machine learning models can identify unusual patterns indicative of fraudulent activity.

3. **Retail**

    1. **Personalized Recommendations**: AI analyzes customer behavior to recommend products.

    2. **Inventory Management**: Predictive analytics helps in managing stock levels efficiently.

4. **Transportation**

    1. **Autonomous Vehicles**: AI powers self-driving cars by processing data from sensors and making real-time driving decisions.

    2. **Traffic Management**: AI optimizes traffic flow and reduces congestion through real-time data analysis.

6. **Customer Service**
   1. **Chatbots**: AI-driven chatbots provide instant customer support and handle routine inquiries.
   2. **Sentiment Analysis**: AI analyzes customer feedback to gauge satisfaction and improve services.

7. **Manufacturing**
   1. **Predictive Maintenance**: AI predicts equipment failures before they occur, reducing downtime.
   2. **Quality Control**: Computer vision systems inspect products for defects.

8. **Education**
   1. **Personalized Learning**: AI tailors educational content to individual student needs.
   2. **Administrative Automation**: AI automates administrative tasks like grading and scheduling.

9. **Entertainment**
   1. **Content Recommendation**: AI suggests movies, music, and other content based on user preferences.
   2. **Game Development**: AI creates realistic non-player characters (NPCs) and adaptive game environments.

10. **Security**
    1. **Surveillance**: AI-powered cameras can detect suspicious activities in real-time.
    2. **Cybersecurity**: AI identifies and mitigates potential security threats.

11. **Agriculture**
    1. **Precision Farming**: AI analyzes data from sensors and drones to optimize crop yields.
    2. **Pest Control**: AI predicts pest outbreaks and recommends control measures.

History of Artificial Intelligence

1950
The time when it all started.

1955
John McCarthy coined term 'Artificial intelligence'.

1974
Computers became faster & affordable

1980
The year of Artificial Intelligence.

2000
Landmark of AI establishment achieved.

A.I. TIMELINE

1950
TURING TEST
Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955
A.I. BORN
Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961
UNIMATE
First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964
ELIZA
Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966
SHAKEY
The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I. WINTER
Many false starts and dead-ends leave A.I. out in the cold

1997
DEEP BLUE
Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998
KISMET
Cynthia Breazeal at MIT introduces KISmet, an emotionally intelligent robot insofar as it detects and responds to people's feelings

1999
AIBO
Sony launches first consumer robot pet dog AiBO (AI robot) with skills and personality that develop over time

2002
ROOMBA
First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes

2011
SIRI
Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S

2011
WATSON
IBM's question answering computer Watson wins first place on popular $1M prize television quiz show *Jeopardy*

2014
EUGENE
Eugene Goostman, a chatbot passes the Turing Test with a third of judges believing Eugene is human

2014
ALEXA
Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks

2016
TAY
Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

2017
ALPHAGO
Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number (2^{170}) of possible positions

ETHICAL CONSIDERATIONS IN AI

ETHICAL

Regulation

Privacy

Mitigation of Bias

Transparency

Relevance

LEGAL

Governance

Confidentiality

Liability

Accuracy

Decision Making

Security

Robot rights

Cognitive Services

Bias

Accountability
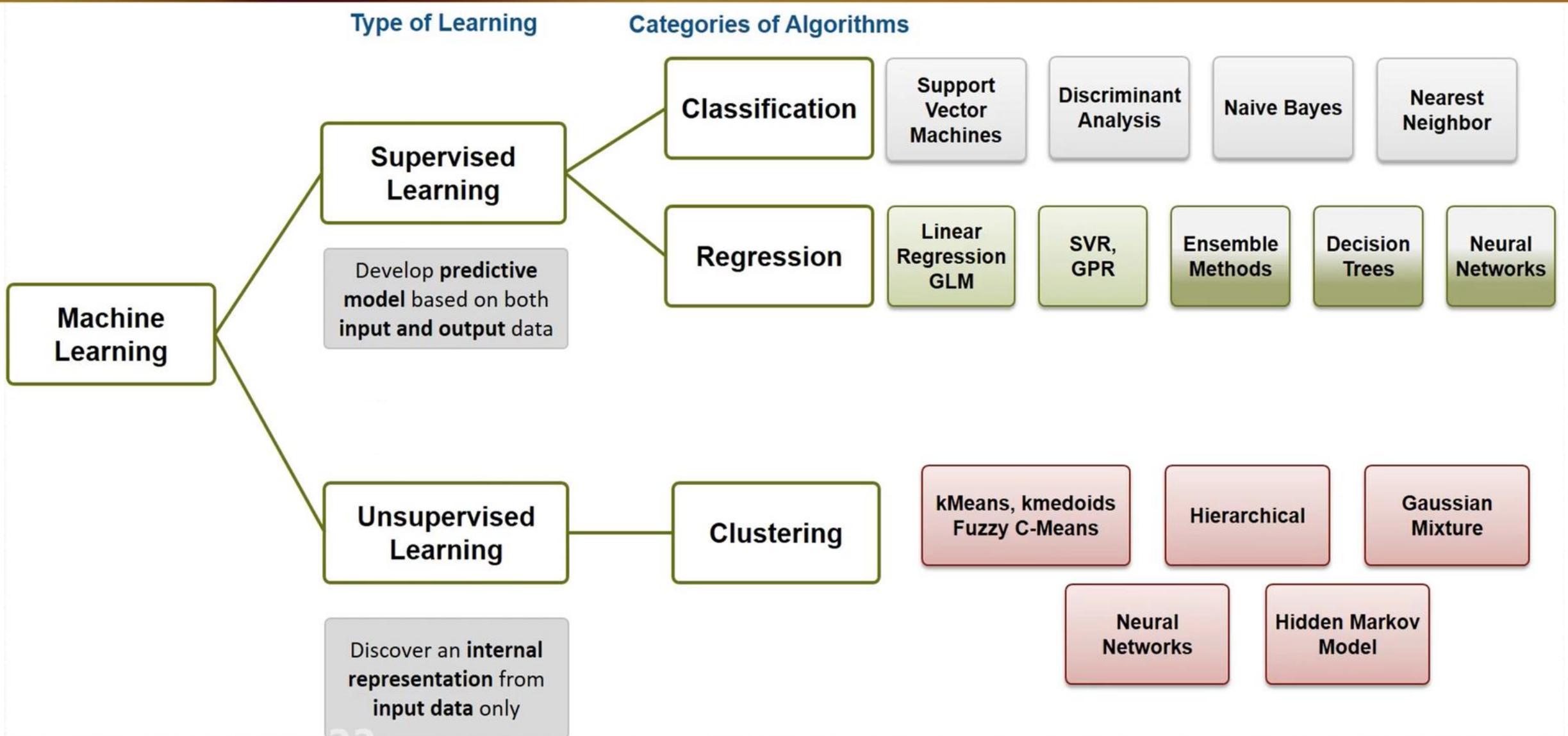
Legal & Ethical Considerations in AI

Planning

Inclusion

Transparency

- Python programming basics

- Libraries and frameworks (e.g., NumPy, Pandas, Matplotlib)

- Introduction to AI-specific libraries (e.g., TensorFlow, PyTorch, Scikit-learn)

- Supervised learning (Linear Regression, Logistic Regression, Decision Trees)

- Unsupervised learning (e.g., K-Means Clustering, Hierarchical Clustering)

- Evaluation metrics (e.g., Accuracy, Precision, Recall, F1 Score)

Type of Learning   **Categories of Algorithms**

Machine Learning

Supervised Learning

Develop **predictive model** based on both **input and output** data

- **Classification**
  - Support Vector Machines
  - Discriminant Analysis
  - Naive Bayes
  - Nearest Neighbor

- **Regression**
  - Linear Regression GLM
  - SVR, GPR
  - Ensemble Methods
  - Decision Trees
  - Neural Networks

Unsupervised Learning

Discover an **internal representation** from **input data** only

- **Clustering**
  - kMeans, kmedoids Fuzzy C-Means
  - Hierarchical
  - Gaussian Mixture
  - Neural Networks
  - Hidden Markov Model

- Introduction to neural networks

- Training and backpropagation

- Convolutional Neural Networks (CNNs) for image processing

- Recurrent Neural Networks (RNNs) for sequence data

- Text preprocessing (e.g., tokenization, stemming, lemmatization)

- Sentiment analysis

- Language models (e.g., Word2Vec, BERT)

|	
◆ 1943: **McCulloch** و **sttiP**	خلق اولین نورون مصنوعی
◆ 1950: **Alan Turing**	معرفی تست تورینگ
◆ 1956: **John McCarthy**	ابداع اصطلاح «هوش مصنوعی»
◆ 1957: **Frank Rosenbla**t	اختراع اولین شبکه‌های عصبی اولیه
◆ 1959: **Bernard Widrow** و **ffoH deT**	ساختن مدل ADALINE
◆ 1969: **Minsky** و **trepaP**	حل مسئله XOR
◆ 1980: **Kunihiko Fukushima**	معرفی نئوکوجنیترو (پایه‌گذار یادگیری عمیق)
◆ 1986: **Geoffrey Hinton** و **trahlemuR diVaD**	معرفی پس‌انتشار (backpropagation)
◆ 1989: **Judea Pearl**	انجام پیشرفت‌هایی در درک و استدلال – UAT
◆ 1995: **Vladimir Vapnik** و **setroC anniroC**	توسعه ماشین‌های بردار پشتیبانی (SVM)
◆ 1998: **Yann LeCun**	محبوب کردن شبکه‌های عصبی کانولوشنی (CNN)
◆ 2006: **Geoffrey Hinton** و **vonidtuhkalaS nalsuR**	معرفی شبکه‌های باور عمیق
◆ 2012: **Alex Krizhevsky** و **notniH yerffoeG**	راه‌اندازی آلکس‌نت (انقلاب مدرن در یادگیری عمیق)
◆ 2014: **Ian Goodfellow**	معرفی شبکه‌های مولد متخاصم (GANs)
◆ 2017: **Ashish Vaswani**	معرفی ترنسفورمرها – دگرگون ساختن پردازش زبان طبیعی (NLP)
◆ 2020: OpenAI	رونمایی مدل GPT-3
◆ 2022: OpenAI	انتشار چت‌جی‌پی‌تی

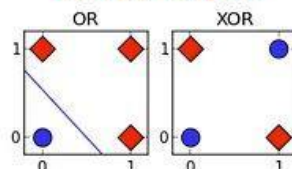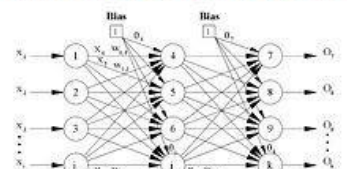# A Brief History of AI with Deep Learning
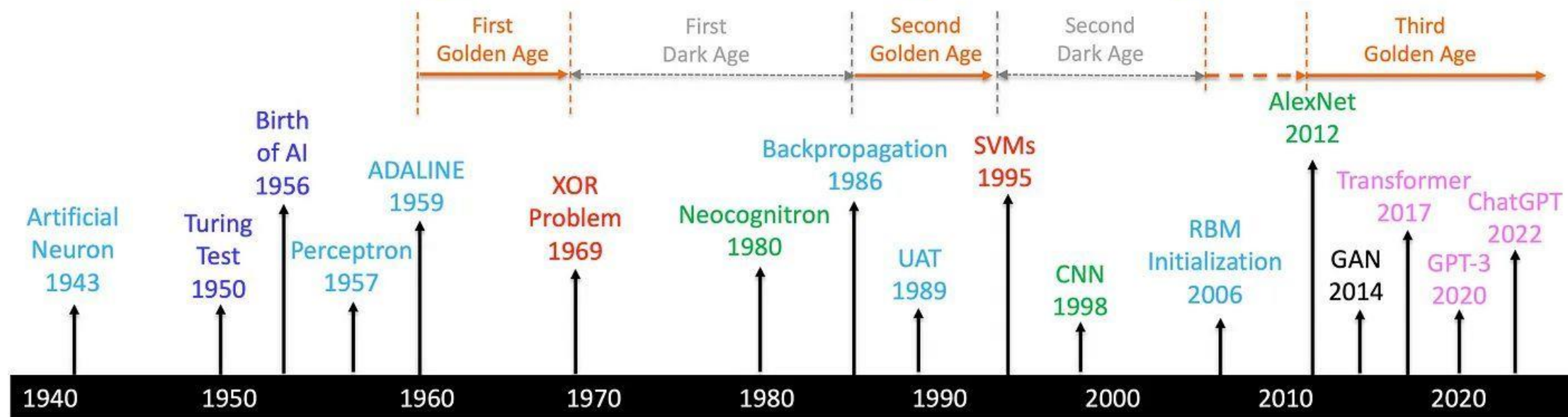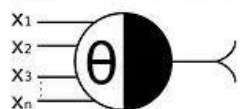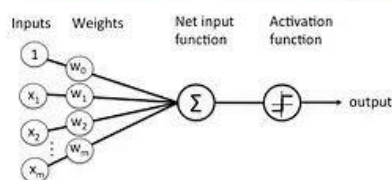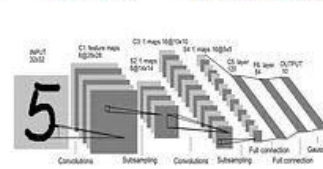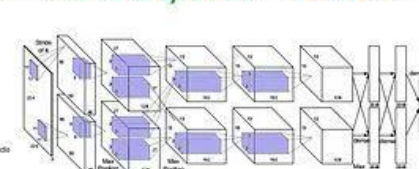
- Install Python

- Looking for Python Basics

- References :

  - Python with Jadi .

  - GitHub . Salimy

Thanks

UCSC Genome Browser on Human (GRCh38/hg38)

Move <<< << < > >> >>> Zoom in 1.5x 3x 10x Base Zoom out 1.5x 3x 10x 100x

New to the Genome Browser? See our short (2-3 minute) guided tutorial. All tutorials can be found in the top blue bar menu under **Help** > **Interactive Tutorial**.

Start tutorial   Don't show again

Multi-region chr7:155,806,122-155,806,277 156 bp. | gene, chromosome range, search terms, help pages, see exampl | Search Examples

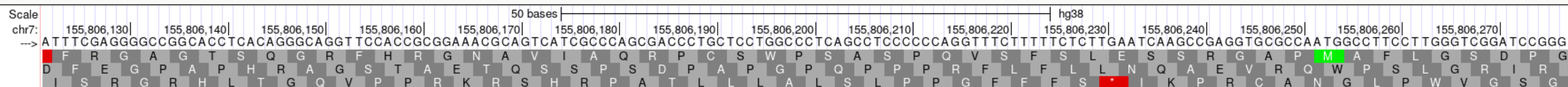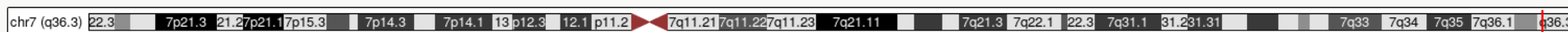chr7 (q36.3) 22.3 7p21.3 21.2 7p21.1 7p15.3 7p14.3 7p14.1 13 p12.3 12.1 p11.2 7q11.21 7q11.22 7q11.23 7q21.11 7q21.3 7q22.1 22.3 7q31.1 31.2 31.31 7q33 7q34 7q35 7q36.1 q36.3

Scale 50 bases hg38
chr7: 155,806,130 155,806,140 155,806,150 155,806,160 155,806,170 155,806,180 155,806,190 155,806,200 155,806,210 155,806,220 155,806,230 155,806,240 155,806,250 155,806,260 155,806,270
---> ATTTCGAGGGGCCGGCACCTCACAGGGCAGGTTCCACCGCGGAAACGCAGTCATCGCCCAGCGACCCTGCTCCTGGCCCTCAGCCTCCCCCCAGGTTTCTTTTTCTCTTGAATCAAGCCGAGGTGCGCCAATGGCCTTCCTTGGGTCGGATCCGGG

Reference Assembly Fix Patch Sequence Alignments
Reference Assembly Alternate Haplotype Sequence Alignments
GENCODE V47 (3 items filtered out)

SHH

RefSeq genes from NCBI

RefSeq Curated

OMIM Alleles OMIM Allelic Variant Phenotypes

OMIM Genes OMIM Gene Phenotypes - Dark Green Can Be Disease-causing

Gene Expression in 54 tissues from GTEx RNA-seq of 17382 samples, 948 donors (V8, Aug 2019)

SHH

ENCODE cCREs ENCODE Candidate Cis-Regulatory Elements (cCREs) combined from all cell types

Layered H3K27Ac H3K27Ac Mark (Often Found Near Regulatory Elements) on 7 cell lines from ENCODE

4 _
Cons 100 Verts 100 vertebrates Basewise Conservation by PhyloP
-0.5 _

Multiz Alignments of 100 Vertebrates
Gaps
Human ATTTCGAGGGGCCGGCACCTCACAGGGCAGGTTCCACCGCGGAAACGCAGTCATCGCCCAGCGACCCTGCTCCTGGCCCTCAGCCTCCCCCCAGGTTTCTTTTTCTCTTGAATCAAGCCGAGGTGCGCCAATGGCCTTCCTTGGGTCGGATCCGGG
Rhesus AGTTCGAGGGGCCGGCACCTCACAGGGCAGGTTCCACCGCGGAAACGCAGTCATCGCCCAGTGCCCTGCTCCTGGCCCTCAGCCTACCCCCAGGTTTCTTTTTCCCTTGAATCAAGCCGGGTCTGCCAGTGGCCTTCCGTGGGGGCGGATCGGGG
Mouse GTACCTGGGGA========TATGTCCCACCACCGAGATCTACTTATTTTCAAGCCTCCCTTTTTTGGCTCTT====CCTTCCTCTCTGTTTTTTCTGGTGGGAGAGGCTGAG========GGGG========TGGAGAAAGGCCAGG
Dog ACTTTTGGGGA========CCAACACCGACTGATTTACCACCGAGGAGACTGAGCTTACTTACCAGCCACCCCTCCCCC====CGTTCATCTCTTTCCCCTCGGCATCCTCTAGC====CCGGCT====AGGGCCAGACG
Elephant A=ACTTTT=GGGG====GGGCCCGCTGGGGGTATGTTCAAAACAAAAC=TAGGCATCACCCCATCCTCTGCCTCCCCTGTCCCTGGCCTCCCCCCTATTAGCCTTTTCCTCGGCATCCGTCCTG=GITCC
Chicken GG======GAGGCAGCACAGGAAGGGGTGGAGGGCTCT====TG========TGC=======CGCCCGGCCT====G====CA
X_tropicalis
Zebrafish

Short Genetic Variants from dbSNP release 155

Common dbSNP(155)